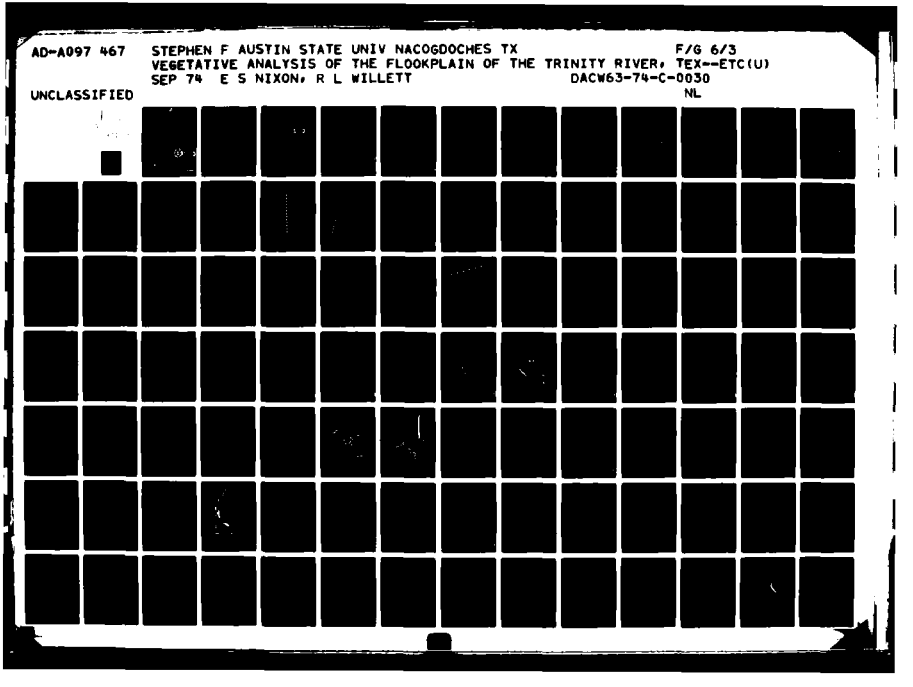
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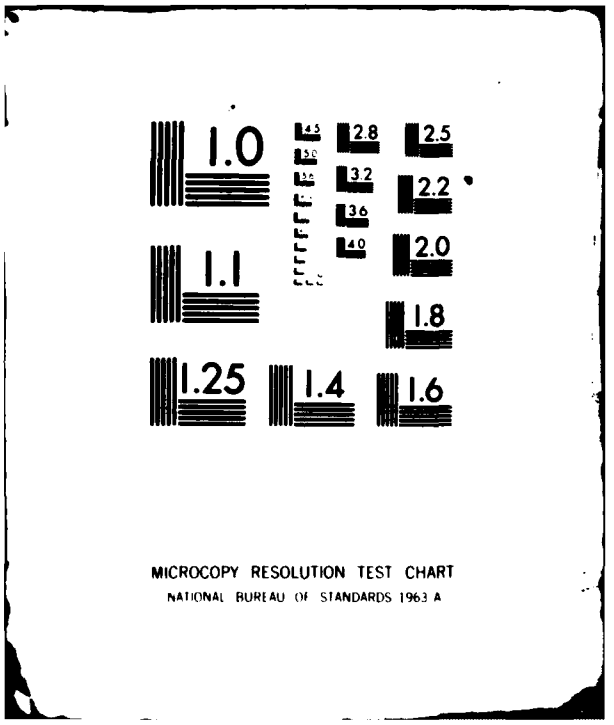
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Vegetative Analysis of the Floodplain of the Trinity River, Texas

STEPHEN F. AUSTIN STATE UNIVERSITY
NACOGDOCHES, TEXAS

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A vegetative study of the floodplain of the Trinity River to analyze and describe representative plant communities. From this data, frequency, density, dominance and important value figures were obtained. A community alludes to any assemblage of organisms in a given area at a given time; locations for this study were chosen so that woody vegetation of the Trinity River floodplain could be characterized. This area is variable from the standpoint of rainfall, soils, and land use. Vegetation type of greatest concern in this study was the bottomland hardwood forest; thus, intra and inter area study sites were selected for woody vegetational analysis.

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20. Checklists were made of woody and herbaceous species that were rare and endangered;which will have impact on the future industrial, residential, and agricultural development of the Trinity River floodplain.

B

VEGETATIVE ANALYSIS

OF THE FLOODPLAIN OF THE TRINITY RIVER, TEXAS

by

Elray S. Nixon
and
R. Larry Willett

Stephen F. Austin State University
Nacogdoches, Texas

Prepared for

U. S. Army Corps of Engineers
Fort Worth District
Fort Worth, Texas
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Preliminary

This report does not necessarily constitute the final project concept to be adopted and approved by the U. S. Army Corps of Engineers.

September 30, 1974

PREFACE

On July 1, 1973, researchers at Stephen F. Austin State University submitted a report to the U. S. Army Corps of Engineers, Fort Worth District, entitled, "Ecological Survey Data for Environmental Considerations on the Trinity River and Tributaries, Texas." Chapter II of this report, which involved botanical elements, included quantitative data based on sampling in each of five vegetational areas traversed by the Trinity River basin between Fort Worth and Trinity Bay.

This report includes data resulting from quantitative sampling and analysis at five locations between November 1973 and September 1974. These locations were chosen so that woody vegetation of the Trinity River flood plain could be characterized. The data from these two separate studies are combined and summarized in this report.

Elray S. Nixon
R. Larry Willett

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To the many landowners who were kind and considerate of our needs and permitted us to work on their land, we extend our sincere thanks. They were helpful beyond our expectations.

We are indebted to the following for their aid in field work and data analyses: Jack E. Bailey, Phillip W. Barnett, Charles L. Burandt, Jr., Michael L. Butts, Paul W. Cox, Charles R. Ellis, Suzy A. Langston, Elizabeth A. Lumpkins, Michael McCrary and W. Garland Willett.

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INTRODUCTION

From its beginning northwest of Fort Worth, Texas, in Archer County, the Trinity River extends some 350 miles (692 river miles) to Trinity Bay (U. S. Study Commission, 1962). The total fall in elevation for the river is approximately 1,250 feet and the river basin comprises a total area of 18,381 square miles. The topography of the basin ranges from flat to gently rolling and hilly.

Vegetatively, the Trinity River Basin is associated with several areas or types. Gould (1969) divides Texas into ten vegetational areas. The Trinity River transects the Pineywoods, Gulf Prairies and Marshes, Post Oak Savannah, Blackland Prairies and the Cross Timbers and Prairies vegetational areas (Fig. 1). Following are brief descriptions of these areas as generally characterized by Gould (1969).

The Trinity River, within the confines of this study, transects only a small portion of the Cross Timbers and Prairies area. The area is very variable from the standpoints of rainfall, soils and land use. The vegetation, however, is generally rather uniform. Predominant native grasses in the prairies are little bluestem (Schizachyrium scoparium), big bluestem (Andropogon gerardi), Indiangrass (Sorghastrum avenaceum), switchgrass (Panicum virgatum) and Canada wild-rye (Elymus canadensis). The Cross Timbers areas are dominated by trees such as post oak (Quercus stellata) and blackjack oak (Quercus marilandica) with herbaceous understory species including hairy tridens (Erioneuron pilosum) and Texas grama (Bouteloua rigidiseta).

The Blackland Prairies, under natural conditions, would be dominated by grasses such as little bluestem, big bluestem, switchgrass, Indiangrass and sideoats grama (Bouteloua curtipendula). The soils are generally dark-colored calcareous clays.

In general, the Post Oak Savannah vegetational area is characterized by the presence of upland trees such as post oak, blackjack oak and sandjack oak (Quercus incana) and of marginal bottomland species including southern red oak (Quercus falcata), white oak (Quercus alba), hickory (Carya spp.) and elm (Ulmus spp.) (Bray, 1906). The upland soils of the Post Oak Savannah area are light-colored, generally acid and are texturally classed as

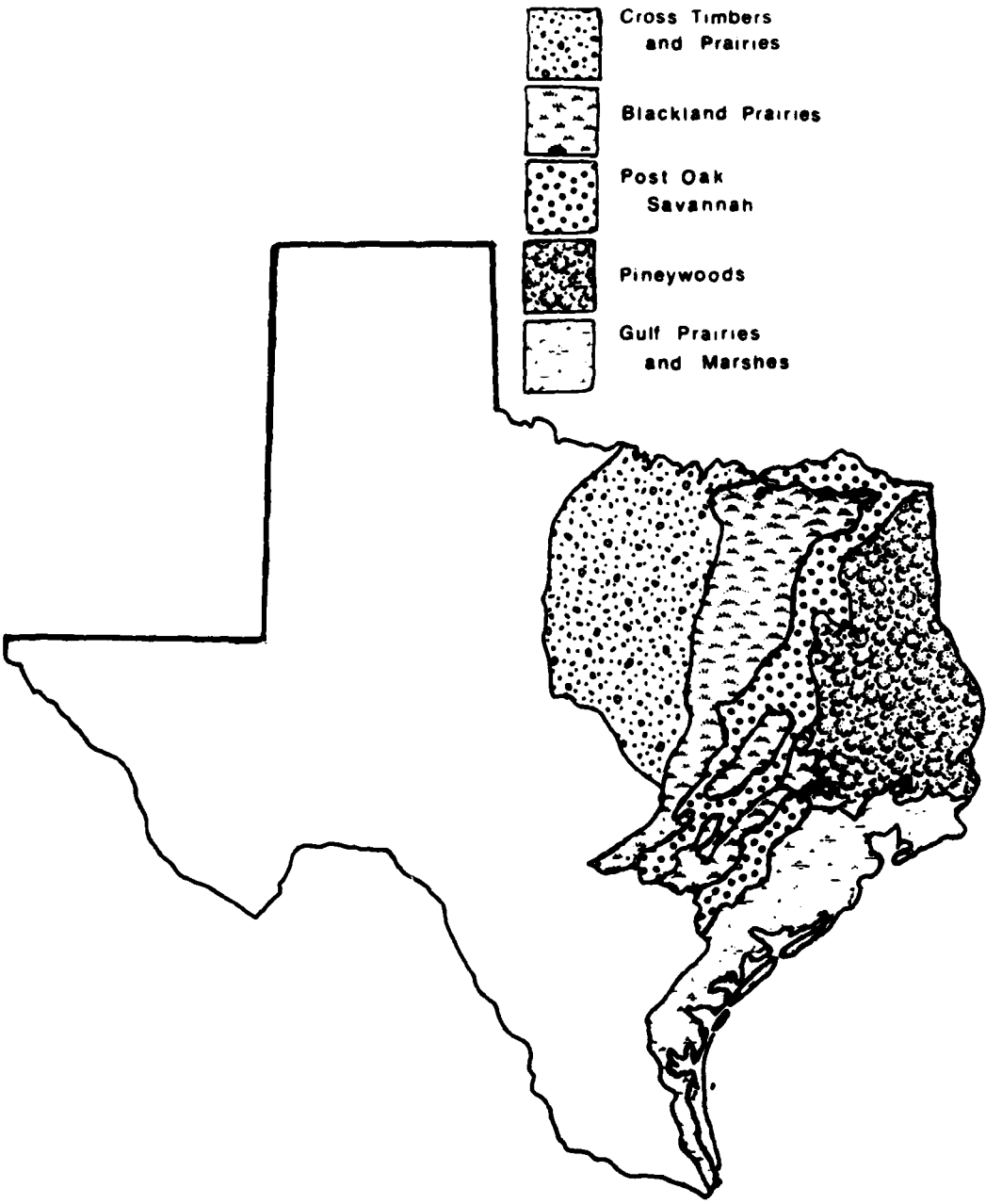


Fig. 1. Vegetational areas of Texas transected by the Trinity River (after Gould, 1969).

either sands or sandy loams. Bottomland soils are darker in color, acid, and range from sandy loams to clays.

The Pineywoods vegetation area is depicted by trees such as shortleaf pine (Pinus echinata), loblolly pine (Pinus taeda), post oak, blackjack oak, red oak, sweetgum (Liquidambar Styraciflua) and black hickory (Carya texana) in the uplands and by overcup oak (Quercus lyrata), willow oak (Quercus Phellos), Texas sugarberry (Celtis laevigata), cedar elm (Ulmus crassifolia) and bush palmetto (Sabal minor) in the bottomlands (Tharp, 1926, 1939, 1952; Braun, 1950). The soils are usually light-colored, acid, and sands or sandy-loams.

The climax vegetation of the flat Gulf Prairies and Marshes area is largely grassland or post oak savannah. Tall bunch grasses such as big bluestem, Indiangrass, eastern gramagrass (Tripsacum dactyloides) and gulf muhly (Muhlenbergia capillaris var. filipes) are characteristic. Soils are generally acid sands, sandy loams and clays.

Although the Trinity River is associated with the above vegetational areas, the vegetation type of great concern in this study was that of bottomland hardwood forest. Bottomland forests associated with the Sabine, Neches, Trinity, and San Jacinto river systems occupy large areas, and as a result, have been classified by Bray (1906) and Collier (1964) as distinct vegetational types. These bottomland forests are considered to be westward extensions of hardwood forests typical of river bottom areas to the southeast (Bray, 1906; Braun, 1950).

OBJECTIVES

The major objective of this study was to analyze and describe representative plant communities located within ten selected study areas associated with the Trinity River. Some interarea communities were also included. In addition, preliminary checklists of woody and herbaceous species with notations on those which were rare and endangered, were to be prepared.

METHODS AND PROCEDURES

Ten representative study areas within the floodplain of the Trinity River were chosen for analysis.

Their approximate location is presented in Figure 2, and they are briefly described as follows:

1. Between Fort Worth and Dallas, west of the Highway 360 crossing of the Trinity River.
2. South of Dallas near the junction of Loop 12 and the Trinity River.
3. West of Rosser, Texas, at the confluence of the Trinity River and the old channel of the East Fork of the river.
4. Northeast of Kerens, Texas, at the large horseshoe bend of the Trinity River in the vicinity of the Bruce Smith Ranch.
5. South of Highway 287 on Richland Creek.
6. Southwest of Palestine, Texas, south of the junction of Highway 79 and the Trinity River.
7. Northeast of Madisonville, Texas, north of the junction of Highway 21 and the Trinity River.
8. South of Livingston, Texas, east of the junction of Highway 59 and the Trinity River.
9. East of Cleveland, Texas, south of the junction of Highway 162 and the Trinity River in the Tanner Bayou area.
10. South of Liberty, Texas, in the vicinity of the Liberty-Chambers county line and its junction with the Trinity River.

Intra- and interarea study sites were selected for woody vegetational analyses and are referred to as communities. A community, as defined in this study, alludes to any assemblage of organisms (in this instance, woody vegetation) in a given area at a given time. Communities were delineated on the basis of a relatively high degree of uniformity in composition and structure, and as a result of their occupying an area of essentially uniform environment.

Quantitative data were acquired for woody shrubs and trees with diameters at breast height (dbh) greater than 1/2 cm whereas vine and herbaceous plants were collected, identified, and incorporated into a checklist. The woody vegetation of all areas was analyzed by the plot method. Each plot was five meters square and situated in a belt transect. Each belt transect, in turn, was composed of two rows of plots following a compass line. Woody species in each plot were identified, measured (dbh) and counted. From this data, frequency, density, dominance and importance value figures were obtained. Dominance, therefore, is based upon importance value (importance value is equal to the sum of the relative frequency, relative density and relative dominance) when used in this study. Nomenclature for plant species followed Correll and Johnston (1970).

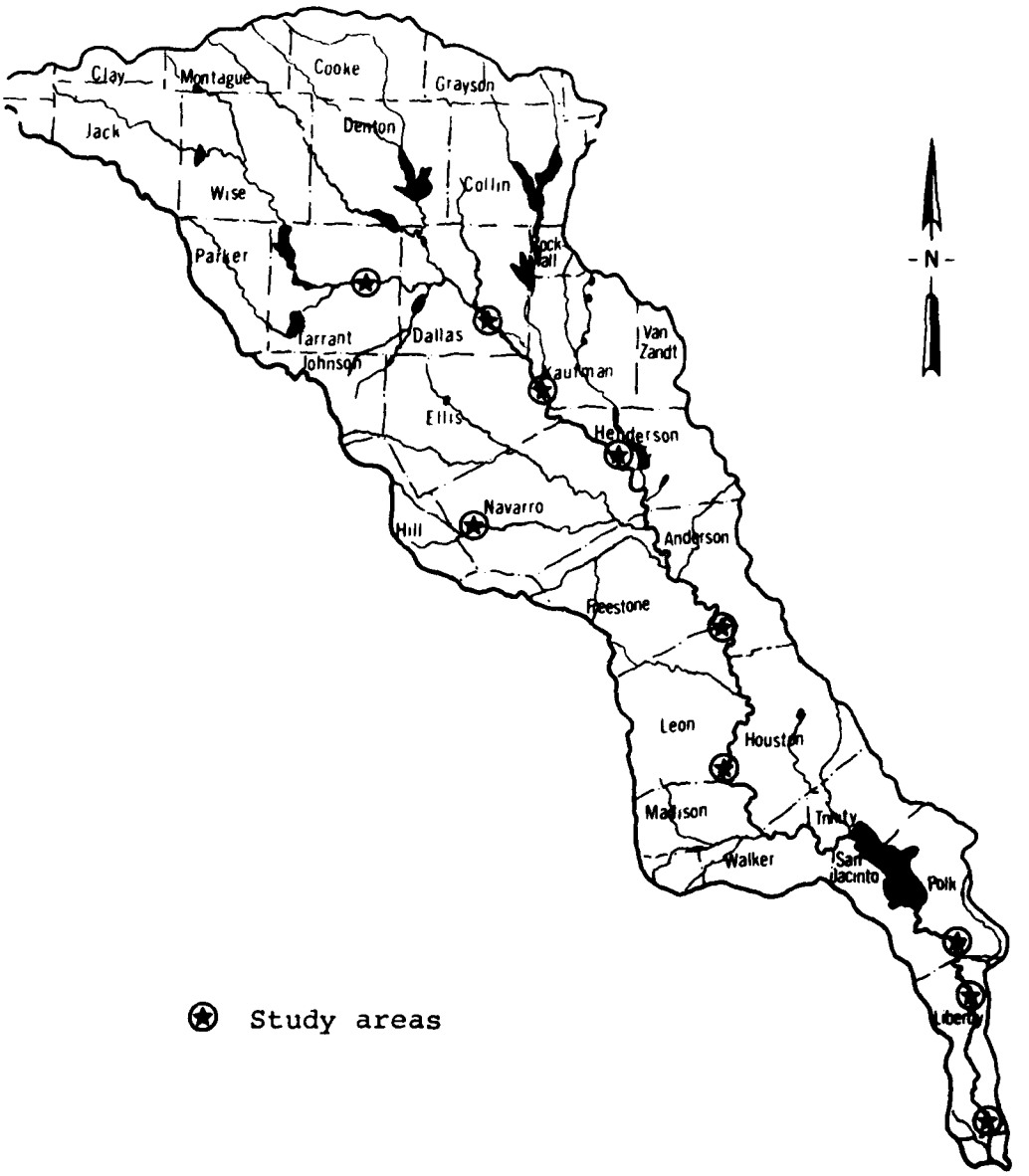


Fig. 2. Study areas and counties in relation to the Trinity River.

STUDY AREA 1

Introduction

Forested areas associated with the floodplain of the West Fork of the Trinity River between Dallas and Fort Worth are relatively discontinuous. The boundary of Study Area 1, therefore is somewhat extended. It begins just west of State Highway 360 and its junction with the river and prolongs westward to within the city limits of Fort Worth. Field analyses were conducted during the late spring of 1974.

The topography within the communities studied was generally flat although some sloughs, depressions and undulating sites were present. Geologically the area is composed of Alluvium deposits of Recent origin within the Quaternary Period. Soils of all study communities are of the Frio series (U. S. Department of Agriculture, unpublished data). These are silty clay soils subject to occasional and sometimes frequent overflow. Depending on frequency of flooding, moderate to severe limitations exist for most recreational and cropland uses. This soil is poorly suited for dwellings and septic tanks but, on the contrary, produces excellent yields of pasture plants (U. S. Department of Agriculture, 1964). It is also well suited for wildlife.

Although much of Tarrant County has been urbanized, surrounding areas in the immediate local of the study communities were mostly pasture and cropland. Selective cutting of trees was generally evident in all study sites whereas grazing by domestic livestock was observed in 4 sites. It is also likely that the fifth site has been subject to grazing in the past.

Land Use

Tarrant County, the fourth most populous county in Texas, had an estimated population of 757,900 in 1972 (Texas Almanac, 1973). Between 1960 and 1970, the county had a populational increase of 33.1%, rising from 538,495 to 716,317 (Texas Almanac, 1971). Tarrant County has a diversified urban economy. Some 1,100 factories produce a variety of products, including aircraft, foods and mobile homes. The economy is closely associated with that of the Dallas urban area.

About 3/4 of Tarrant County was classified as commercial farm and forest area in 1967 (Table 1) (Tarrant

Table 1. Tarrant County land area (in acres)
(from Tarrant County Conservation Needs Inventory Committee, 1967)

Land Use	1958	1967
Total land area	555,200	555,200
Less: Federal non-cropland	4,147	4,147
Less: Urban and built-up	107,271	133,354
Less: Small water areas	2,200	2,450
Total non-commercial area	113,618*	139,951
Total commercial farm and forest area	437,028*	415,249
Cropland	232,597	124,061
Pasture	31,940	167,983
Range	104,722	61,498
Forest	55,780	42,424
Other land	11,989	19,283

* The failure of these two figures to add up to total area is due to discrepancies in original data.

County Conservation Needs Inventory Committee, 1967). On the average, this land contributes only $15 million to the total annual income, which was $3,004,951,000 in 1972 (Texas Almanac, 1973). Of this average annual agricultural income, over 80% comes from dairy and beef cattle, hogs and poultry. Grain sorghams, small grains, cotton, pecans and peaches are also produced.

Land classified as urban and built-up increased from 107,271 to 133,354 acres (24%) between 1958 and 1967 (Table 1). With the population of Tarrant County rapidly growing and expanding, the 1967 urban and built-up figure is certainly low in regard to 1974 land use.

The most pronounced trend in land use between 1958 and 1967 was the conversion of cropland to pasture. In this period, cropland decreased from 232,597 to 124,061 acres (47%), while pasture increased dramatically from 31,940 to 167,983 acres (426%). Part of this gain was at the expense of range, which decreased from 104,722 to 61,498 acres. However, range and pasture together totaled 136,662 acres in 1958 but increased to 229,481 acres in 1967, a gain of 68%. Forest land, mainly confined to water courses, decreased from 55,780 to 42,424 acres (24%) in the same period. The classification "other land" which includes non-urban homesites, showed a gain from 11,989 to 19,283 acres (61%) between 1958 and 1967.

An appraisal of potential for outdoor recreational development in Tarrant County (Graves, et al, 1967) estimates that a high potential exists for picnicking, golf courses, historic sites and transient camping. Riding stables were given a medium high rating for development. Play areas, bicycling, fishing, natural and scenic areas, shooting preserves and water sports areas rated only a medium potential in this survey. Vacation cabins, cottages and homesites received a low rating because cities are spread out over the county, and suitable unincorporated areas are being used for permanent homesites. For much the same reason, potential for vacation site camping and vacation farms and ranches also received a low rating.

Methods and Procedures

Study Area 1 consisted of 5 study communities. A total of 753 five-meter-square plots were analyzed in belt transects with 50 plots located in Community 1, 202 in Community 2, 100 in Community 3, 201 in Community 4 and 200 in Community 5. The positions of belt transects within each community are presented in Figures 3, 4 and 5.

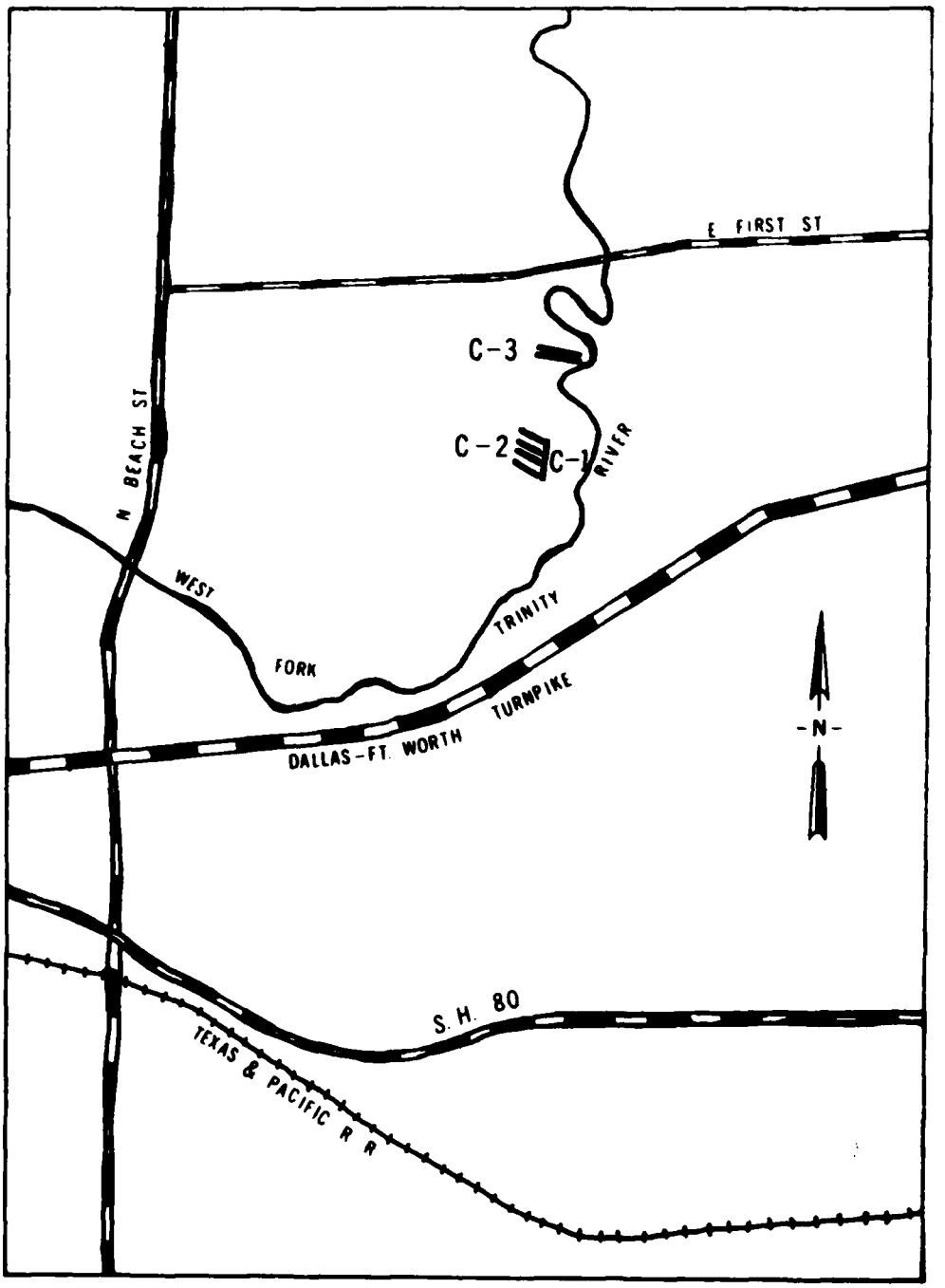


Fig. 3. Location of Communities 1, 2 and 3 (C-1, C-2 and C-3) and position of study transects (solid lines).

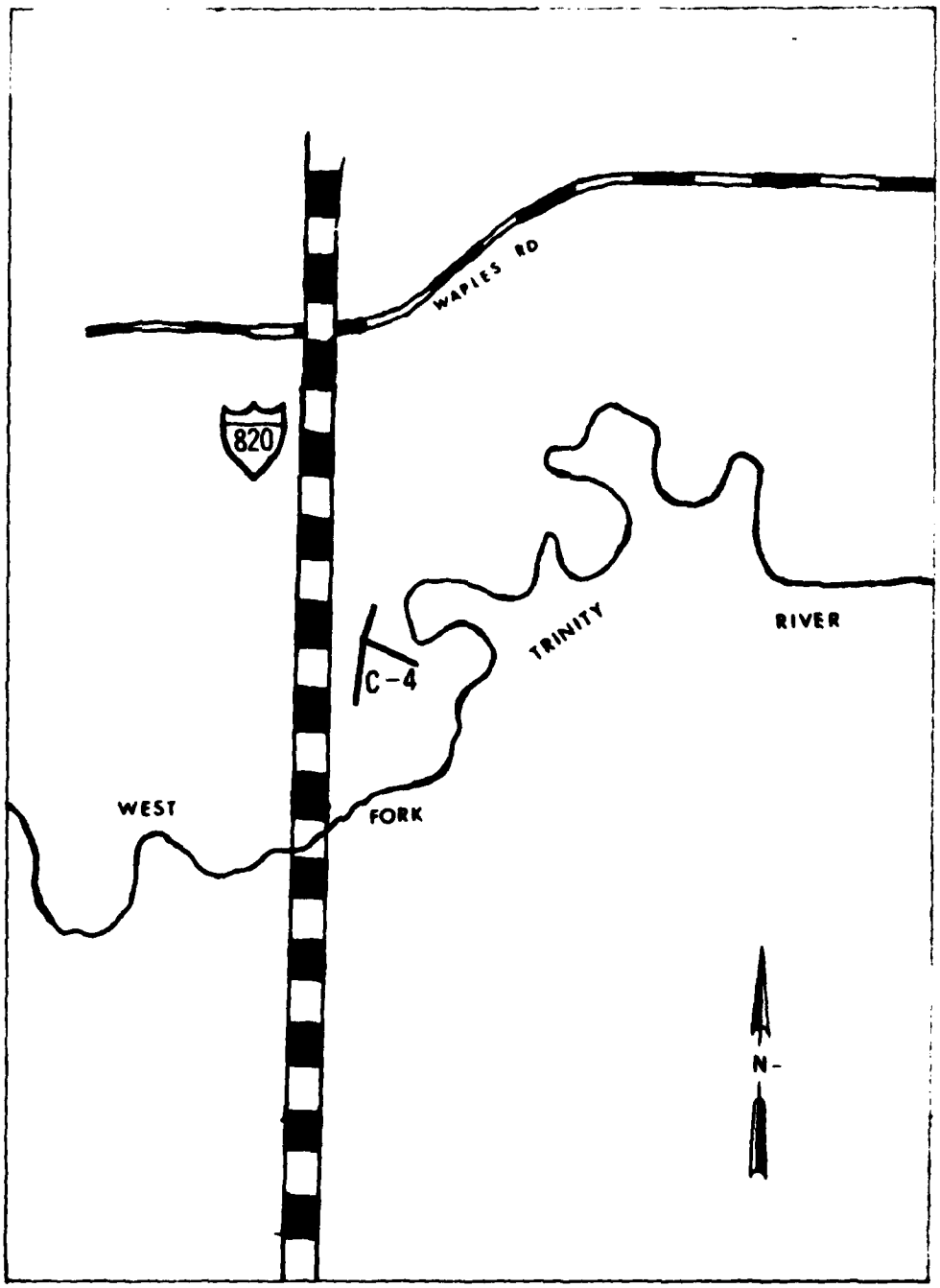


Fig. 4. Location of Community 4 (C-4) and position of study transects (solid lines).

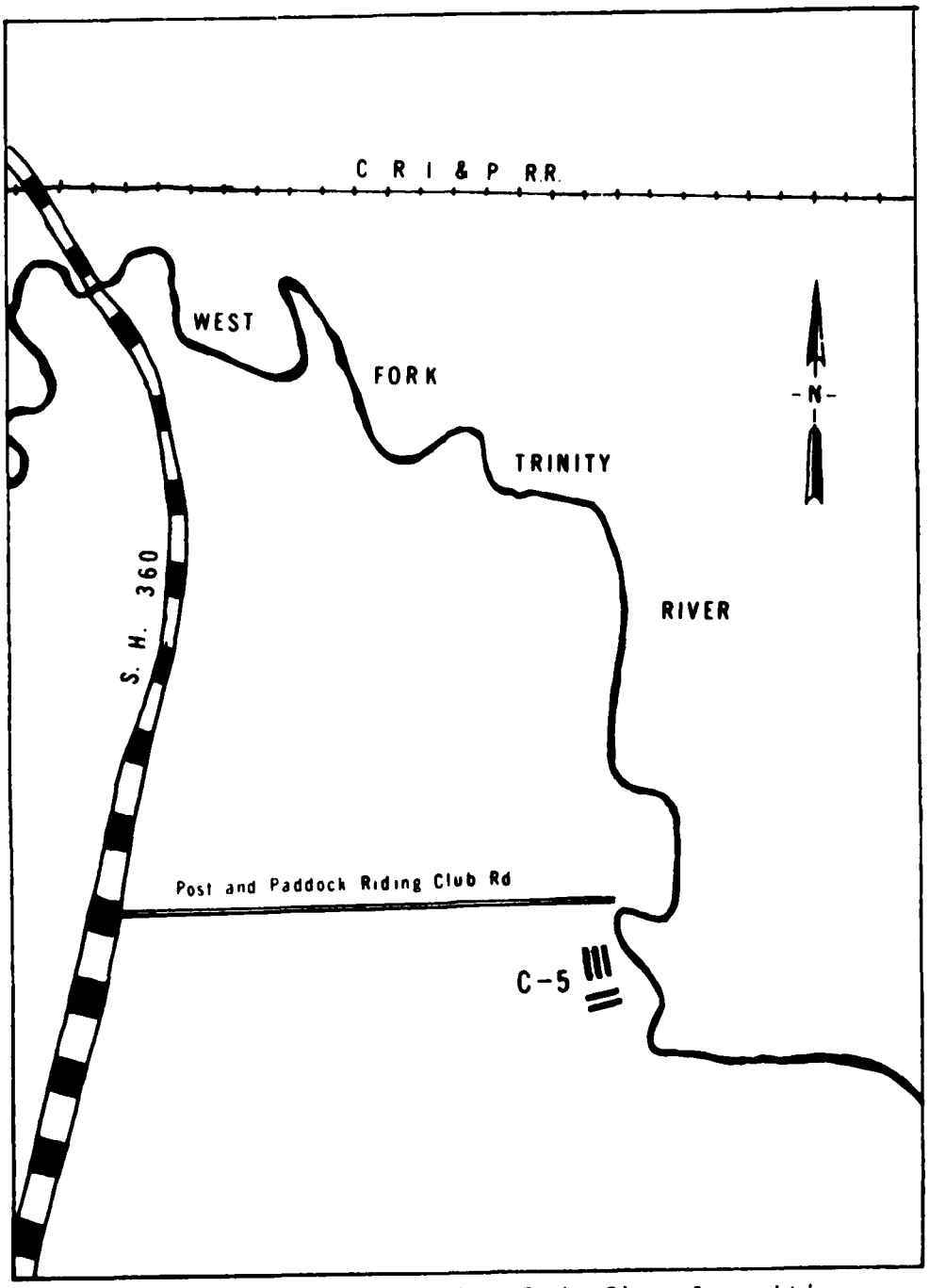


Fig. 5. Location of Community 5 (C-5) and position of study transects (solid lines).

Description of Study Sites

Communities 1, 2 and 3 were located west of Randol Mill Road just south of the junction of East First Street and the West Fork of the Trinity River (Fig. 3). These communities were on three variously elevated sites. Community 1 was located within what may have been the old channel of the river. It is likely that this site is wet during most of the year. A lack of herbaceous ground cover was generally compensated for by a moderate amount of litter. Community 2 was situated on a more dry elevated site contiguous with Community 1 (Fig. 3). It was also characterized by a somewhat undulating topography. The most elevated of the three sites maintained Community 3. The topography was flat. Grasses and sedges were the basic constituents of the herbaceous layer in Communities 2 and 3 with Community 2 having the greatest amount of litter.

Community 4 was situated just northeast of the junction of the West Fork of the Trinity River and Highway 820 (Fig 4). The topography was flat with an occasional depression. Virginia wild rye (Elymus virginicus) and coral-berry (Symphoricarpos orbiculatus) appeared to dominate the herb and shrub layers, respectively.

Community 5 was located within the confines of the Post and Paddock Riding Club southwest of the junction of Highway 360 and the West Fork of the Trinity (Fig. 5). The topography was generally flat but due to the presence of a winding creek, the area appeared to be slightly rolling. Grasses generally dominated the herbaceous layer.

Results

Community 1

Because of the slough-like site sustaining Community 1, the area was dominated by swamp privet (Forestiera acuminata) Table 2). Associated with swamp privet were small trees of box elder (Acer Negundo), Chinaberry (Melia azedarach) and red mulberry (Morus rubra) and an occasional large tree of eastern cottonwood (Populus deltoides)(Tables 2 and 3). Only 5 species were recorded in Community 1 and they averaged almost 7 plants per plot. The community appeared more dense, however, as a result of the branching habit of swamp privet.

Table 2. Frequency, density, and dominance data for plant species located in Community 1.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Forestiera acuminata	98.0	67.1	5.62	83.6	65.8	216.5
Populus deltoides	4.0	2.7	.04	.6	33.8	37.1
Acer Negundo	34.0	23.3	.68	10.1	.3	33.7
Melia azedarach	6.0	4.1	.34	5.1	.1	9.3
Morus rubra	4.0	2.7	.04	.6	**	3.3
Total		99.9	6.72	100.0	100.0	299.9

* Sum of relative frequency, relative density and relative dominance.

** Value less than 0.1.

Table 3. Size classes (dbh) of plant species located in Community 1.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Forestiera acuminata	206	42	2							
Populus deltoides						1		1		
Acer Negundo	34									
Melia azedarach	17									
Morus rubra	2									
Total	259	42	2			1		1		

Community 2

The principal species in Community 2 were Texas sugarberry (Celtis laevigata), box elder and cedar elm (Ulmus crassifolia) (Table 4). American elm (Ulmus americana), swamp privet, green ash (Fraxinus pensylvanica), red mulberry and cottonwood were less prevalent. An interesting facet of this community was the large size and fairly good size class distribution of tree species present. Large trees of American elm, cottonwood, sycamore (Platanus occidentalis) and pecan (Carya illinoinensis) were scattered throughout. A pecan and sycamore, neither recorded in plots, measured 11 and 12 feet in circumference respectively. As indicated by the small number of plants per plot (3.80), and due to a rather dense canopy, the understory was generally open.

Community 3

The vegetative analysis of Community 3 revealed the occurrence of a cedar elm flat. The woody community consisted chiefly of cedar elm, with soap-berry (Sapindus Saponaria), Texas sugarberry, hawthorn (Crataegus spp.) and gum bumelia (Bumelia lanuginosa) only occasionally recorded (Table 6). Trees were generally small (Table 7) and along with the presence of an open understory gave the community a rather featureless physiognamy.

Community 4

Community 4 was composed primarily of cedar elm associated with Texas sugarberry (Table 8). Green ash, soap berry and hawthorn were also somewhat prevalent. The community was rather uniform with cedar elm, Texas sugarberry and green ash comprising the upper canopy and soap-berry, hawthorn and swamp privet the mid-layer. Swamp privet, however, was generally confined to wet areas within the community. Trees were generally less than 40 cm in diameter (dbh) (Table 9).

Community 5

As in Communities 3 and 4, Community 5 once again contained a preponderance of cedar elm (Table 10). Texas sugarberry was quite frequent within Community 5 whereas green ash and American elm were only occasionally recorded. Tree diameters were generally less than 50 cm (Table 11). It should be noted that there were several large pecans and American elms in the study area that were not recorded in plots.

Table 4. Frequency, density and dominance data for plant species located in Community 2.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Celtis laevigata	47.5	21.2	0.72	18.8	22.1	62.1
Acer Negundo	44.6	19.9	1.12	29.3	8.5	57.7
Ulmus crassifolia	32.2	14.4	0.61	15.9	10.0	40.3
Ulmus americana**	13.9	6.2	0.17	4.5	16.5	27.2
Forestiera acuminata	26.2	11.7	0.52	13.5	1.6	26.8
Fraxinus pensylvanica	15.8	7.1	0.19	4.9	6.4	18.4
Morus rubra	15.3	6.9	0.16	4.3	3.2	14.4
Populus deltoides	2.0	0.9	0.02	0.5	11.8	13.2
Platanus occidentalis	1.5	0.7	0.01	0.4	6.6	7.7
Carya illinoinensis	1.5	0.7	0.01	0.4	6.4	7.5
Others***		10.3	0.27	7.7	6.9	24.9
Total	----	100.0	3.80	100.2	100.0	300.2

* Sum of the relative frequency, relative density and relative dominance.

** May include Ulmus rubra.

***Other species present listed in order of decreasing importance values: Melia azedarach, Salix nigra, Maclura pomifera, Sapindus Saponaria, Ilex decidua, Sambucus canadensis, Morus alba, Bumelia lanuginosa, Gleditsia triacanthos, Sophora affinis, Ligustrum spp., Euonymous atropurpureus, Crataegus spp., Quercus macrocarpa.

Table 5. Size classes (dbh) of plant species located in Community 2.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Celtis laevigata	80	41	15	6	1	3				
Acer Negundo	200	20	4	1	2					
Ulmus crassifolia	94	17	7	3	1	1				
Ulmus americana*	11	9	4	2	6	2		1		
Forestiera acuminata	101	4								
Fraxinus pensylvanica	12	15	10	1						
Morus rubra	16	15		1	1					
Populus deltoides					1	1			2	
Platanus occidentalis					1		1	1		
Carya illinoinensis	1						1		1	
Others**	40	10	4	3	1					
Total	555	131	44	17	14	7	2	2	3	

* May include Ulmus rubra.

** See Table 4 for a list of other species present.

Table 6. Frequency, density and dominance data for plant species located in Community 3.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Ulmus crassifolia	90.0	48.4	3.39	64.8	78.4	191.6
Sapindus Saponaria	33.0	17.7	0.78	14.9	7.2	39.8
Celtis laevigata	34.0	18.3	0.58	11 1	10.2	39.6
Crataegus spp.	13.0	7.0	0.30	5.7	1.2	13.9
Bumelia lanuginosa	12.0	6.5	0.14	2.7	3.0	12.2
Sophora affinis	2.0	1.1	0.02	0.4	**	1.5
Ilex decidua	1.0	0.5	0.01	0.2	0.1	0.8
Fraxinus pensylvanica	1.0	0.5	0.01	0.2	**	0.7
Total	---	100.0	5.23	100.0	100.1	300.1

* Sum of relative frequency, relative density and relative dominance.

** Value less than 0.1.

Table 7. Size classes (dbh) of plant species located in Community 3.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Ulmus crassifolia	208	99	22	10						
Sapindus Saponaria	62	14	2							
Celtis laevigata	33	23	2							
Crataegus spp.	30									
Bumelia lanuginosa	10	3	1							
Sophora affinis	2									
Ilex decidua	1									
Fraxinus pensylvanica	1									
Total	347	139	27	10						

Table 8. Frequency, density and dominance data for plant species located in Community 4.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Ulmus crassifolia	81.1	26.5	4.05	39.4	59.4	125.3
Celtis laevigata	71.6	23.4	2.33	22.7	23.1	69.2
Fraxinus pensylvanica	38.3	12.5	1.11	10.8	3.5	26.8
Sapindus Saponaria	35.3	11.5	1.02	10.0	2.8	24.3
Crataegus spp.	28.9	9.4	0.74	7.2	3.6	20.2
Forestiera acuminata	7.0	2.3	0.48	4.6	0.5	7.4
Bumelia lanuginosa	10.9	3.6	0.11	1.1	2.6	7.3
Maclura pomifera	9.5	3.1	0.16	1.5	1.6	6.2
Quercus macrocarpa	4.0	1.3	0.04	0.4	2.5	4.2
Sophora affinis	6.5	2.1	0.09	0.9	**	3.0
Others***	13.5	4.5	0.12	1.2	0.2	5.9
Total	----	100.2	10.25	99.8	99.8	299.8

* Sum of relative frequency, relative density and relative dominance.

** Value less than 0.1.

***Other species present listed in order of decreasing importance values: Gleditsia triacanthos, Ilex decidua, Ligustrum spp., Fraxinus americana, Morus rubra, Morus alba, Carya illinoinensis.

Table 9. Size classes (dbh) of plant species located in Community 4.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Ulmus crassifolia	635	87	48	38	5					
Celtis laevigata	391	36	27	11		1				
Fraxinus pensylvanica	217	4	1	1						
Sapindus Saponaria	201	4	3							
Crataegus spp.	129	18								
Forestiera acuminata	96									
Bumelia lanuginosa	14	5	3	1						
Maclura pomifera	26	6								
Quercus macrocarpa	7			1		1				
Sophora affinis	19									
Others*	24	1								
Total	1759	161	82	52	5	2				

*See Table 8 for a list of other species present.

Table 10. Frequency, density and dominance data for plant species located in Community 5.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Ulmus crassifolia	94.5	48.3	5.07	71.9	61.0	181.2
Celtis laevigata	44.0	22.5	1.04	14.9	17.5	54.9
Fraxinus pensylvanica	12.5	6.4	0.25	3.6	7.7	17.7
Ulmus americana**	8.5	4.4	0.11	1.5	5.2	11.1
Maclura pomifera	5.0	2.6	0.09	1.3	1.7	5.6
Crataegus spp.	6.0	3.1	0.13	1.8	0.5	5.4
Bumelia lanuginosa	6.0	3.1	0.07	0.9	0.4	4.4
Carya illinoinensis	1.0	0.5	0.01	0.1	3.8	4.4
Ilex decidua	4.0	2.0	0.07	0.9	0.1	3.0
Gleditsia triacanthos	2.5	1.3	0.03	0.4	0.6	2.3
Others***	12.0	6.3	0.18	2.4	1.4	10.1
Total		100.5	7.05	99.7	99.9	300.1

* Sum of relative frequency, relative density and relative dominance.

** May include Ulmus rubra.

*** Other species present listed in order of decreasing importance values: Morus rubra, Forestiera acuminata, Juniperus virginiana, Acer Negundo, Sophora affinis, Viburnum rufidulum, Ligustrum japonica, Euonymous atropurpureus.

Table 11. Size classes (dbh) of plant species located in Community 5.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Ulmus crassifolia	733	227	42	12	1					
Celtis laevigata	116	71	16	4	1					
Fraxinus pensylvanica	22	20	4	3	1					
Ulmus americana*	6	7	4	4						
Maclura pomifera	9	8	1							
Crataegus spp.	24	1								
Bumelia lanuginosa	11	2								
Carya illinoinensis					1		1			
Ilex decidua	13									
Gleditsia triacanthos	1	3	1							
Others**	27	2	2							
Total	962	341	70	23	4		1			

* May include Ulmus rubra.

** See Table 10 for a list of other species present.

STUDY AREA 2

Introduction

Study Area 2 was situated in the floodplain of the Trinity River in the southeast corner of Dallas County. More specifically it was located southeast of the junction of Interstate Highways 45 and 635 in the vicinity of the Fin and Feather Club and Dallas Hunting and Fishing Club lakes. Field analyses were accomplished during the spring of 1973.

Topography of the immediate study sites was generally flat with occasional depressions and small creeks. Geologically the area is composed of Alluvium deposits of Recent origin within the Quaternary Period. Indistinct low terrace deposits may also be included. Soils in Study Area 2 are comprised of Trinity Clay. This soil type is poorly suited for dwellings, septic tanks, streets, light industry, and camp areas and most other recreational use (U. S. Department of Agriculture, Soil Conservation Service, 1972).

The study sites were forested whereas surrounding areas were generally cleared for pasture, housing and gravel pit usage. Grazing by cattle was evident in one study site and it is likely that the other study sites have been used for domestic grazing in the past.

Land Use

Dallas County, in which is situated the State's second largest metropolitan center, had a population in 1970 of 1,327,321, up sharply from 951,527 in 1960 (Texas Almanac, 1971). Forty-eight percent of the county's total area is classified urban and built-up (Table 12) (Dallas County Conservation Needs Inventory Committee, 1970). While slightly over half of the total area in farm and forest land, its contribution to the income of the county is comparatively small-- about $11 million annually out of a total income in excess of $5 billion.

Between 1958 and 1967, over 43,000 acres were put into urban development (Table 12) (Dallas County Conservation Needs Inventory Committee, 1970). Over 60,000 acres were taken out of row crop cultivation during this time, and pastureland increased by nearly 59,000 acres. Rangeland decreased by nearly 32,000 acres and forest land by almost 35,000 acres. "Other lands", including farmsteads and rural land for residences, increased

Table 12. Dallas County land area (in acres)
(from Dallas County Conservation Needs Inventory Committee, 1970.)

Land Use	1958	1967
Total land area	552,040	552,040
Less: Federal non-cropland	1,307	1,223
Less: Urban and built-up	221,398	264,637
Less: Small water areas	528	580
Total non-commercial area	223,233*	266,440
Total commercial farm and forest area	347,687*	285,600
Cropland	198,394	138,232
Pasture	37,451	96,273
Range**	60,291	28,594
Forest**	42,614	7,613
Other land	8,937	14,888

* The failure of these two figures to add up to total area is due to discrepancies in original data.

** Part of decrease in rangeland and (especially) forest land acreages is due to difference in interpretation of land uses in 1958.

nearly 6,000 acres.

An appraisal of potential for outdoor recreational developments in Dallas County (Anonymous, 1967a) stated that the large population of the county causes potential to be high for some outdoor recreational enterprises. At the same time, however, the dense population and urban build-up adversely affect other enterprises which depend to a great extent on the natural environment. A high potential was judged to exist for play and target areas, bicycling, picnicking, golf courses, and riding stables. Fishing and water sports have only medium potential due to the limited lakes and inpoundment sites and the already heavy use of existing areas. Medium potential is said to exist for vacation homes, limited mainly by the few available water areas. Overall, Dallas County is a consumer rather than a supplier of outdoor recreation.

Methods and Procedures

Three study sites comprised Study Area 2 (Fig. 6). The more undisturbed plant communities were selected to represent the woody vegetation of this area. The position of study transects is presented in Figure 6. A total of 600 plots ($5m^2$) were analyzed with two hundred being located in each study site.

Description of Study Sites

Community 6 was a forest within the Fin and Feather Club area and was located between the northern end of the Fin and Feather Club Lake and the Trinity River (Fig. 6). The area was flat with occasional, shallow, water-filled depressions. These depressions are probably dry during most of the summer and fall. The area was selectively logged in 1972 resulting in the removal of many large trees. Community 7 was located east of the Trinity River between the river and Dowdy Ferry Road (Fig. 6). It was a flat, poorly drained site in the vicinity of a small creek. Water stands in much of the area after heavy rains. Community 8 was characterized by a greater habitat diversity as a result of a slightly elevated and better drained area bordering a wet flat. This site was located just east of the junction of Dowdy Ferry Road and the Trinity River (Fig. 6). The forest has not been logged for many years as a result of its preservation by the Dallas Hunting and Fishing Club.

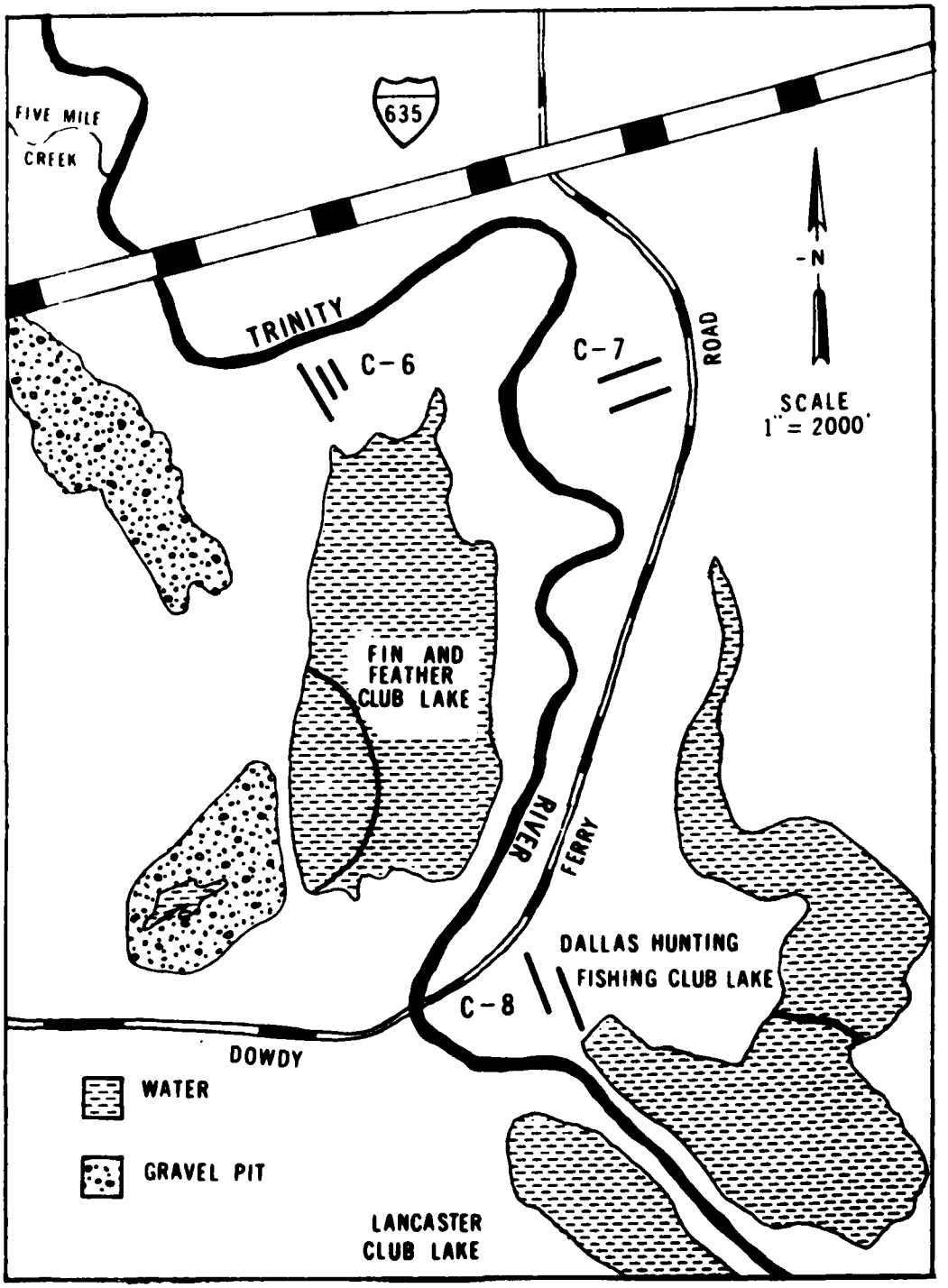


Fig. 6. Location of Communities 6, 7 and 8 (C-6, C-7 and C-8) and position of study transects (solid lines).

Results

Community 6

Pecan (Carya illinoinensis) was the dominant species at Community 6 associated with cedar elm (Ulmus crassifolia), deciduous holly (Ilex decidua), Texas sugarberry (Celtis laevigata) and roughleaf dogwood (Cornus Drummondii) (Table 13). The forest understory was somewhat open and contained a rather uniform herb layer of sedges (Carex spp.) and violets (Viola spp.). Large trees present were mostly pecan (Table 14). There was a fairly good species diversity at Community 6 with 25 species being recorded.

Community 7

The forest comprising Community 7 was rather uniform in species composition with only 10 species being recorded. Texas sugarberry, cedar elm, swamp privet (Forestiera acuminata) and green ash (Fraxinus pensylvanica) were by far the dominant species (Table 15). Osage orange (Maclura pomifera), soap-berry (Sapindus Saponaria) and honey locust (Gleditsia triacanthos) were only occasionally observed. Most trees in the area were less than 30 cm in diameter at breast height (Table 16). Some large cedar elm and green ash trees were present. Except for a few dense populations of cedar elm, the shrub layer was generally open. Empirical observation indicates that the herb layer was composed primarily of sedges with frequently occurring plants of buttercup (Rannunculus carolinianus) and crow poison (Nothoscordum bivalve).

Community 8

The habitat diversity at Community 8 resulted in a greater species diversity as indicated by the recording of 30 species. Understory vegetational layers were also more dense and diversified. The principal tree species in the area were green ash, cedar elm, deciduous holly and roughleaf dogwood (Table 17). Shumard red oak (Quercus Shumardii), pecan, eastern red cedar (Juniperus virginiana) and American elm (Ulmus americana) were prevalent associated species. Tree diameters were generally less than 50 cm although a few larger trees were recorded (Table 18).

Table 13. Frequency, density and dominance data for plant species located in Community 6.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Carya illinoinensis	34.0	9.6	0.40	6.4	38.3	54.3
Ulmus crassifolia	43.0	12.2	0.67	10.8	15.0	38.0
Ilex decidua	57.0	16.1	1.14	18.4	2.4	36.9
Celtis laevigata	48.5	13.7	0.80	12.9	8.6	35.2
Cornus Drummondii	39.0	11.0	1.39	22.4	0.8	34.2
Ulmus americana**	17.5	5.0	0.18	2.9	6.7	14.6
Quercus macrocarpa	5.5	1.6	0.06	0.9	8.5	11.0
Juniperus virginiana	18.5	5.2	0.23	3.7	1.4	10.3
Fraxinus pensylvanica	12.0	3.4	0.30	4.9	1.7	10.0
Morus rubra	12.5	3.5	0.15	2.3	1.8	7.6
Others***		18.5	0.94	14.3	14.8	47.6
Total	----	99.8	6.26	99.9	100.0	299.7

* Sum of relative frequency, relative density, and relative dominance.

** May include Ulmus rubra.

*** Other species present listed in order of decreasing importance values: Quercus Shumardii, Sapindus Saponaria, Maclura pomifera, Bumelia lanuginosa, Acer Negundo, Fraxinus americana, Viburnum rufidulum, Prunus mexicana, Amorpha fruticosa, Diospyros virginiana, Gleditsia triacanthos, Cercis canadensis, Ligustrum spp., Forestiera acuminata, Populus deltoides.

Table 14. Size classes (dbh) of plant species located in Community 6.

Species	Size Classes (cm)								
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Carya illinoinensis	6	11	36	18	5	3				
Ulmus crassifolia	77	38	13	5	1					
Ilex decidua	227									
Celtis laevigata	107	48	4							
Cornus Drummondii	277									
Ulmus americana*	12	18	2	2	2					
Quercus macrocarpa	1	2	1	2	4		1			
Juniperus virginiana	42	2		2						
Fraxinus pensylvanica	52	5	3							
Morus rubra	16	13								
Others**	142	25	9	1	1		1	1		
Total	959	162	68	30	13	3	2	1		

* May include Ulmus rubra.

** See Table 13 for a list of other species present.

Table 15. Frequency, density, and dominance data for plant species located in Community 7.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Celtis laevigata	58.0	29.9	3.19	49.4	19.6	98.9
Ulmus crassifolia	47.5	24.5	1.27	19.7	33.6	77.8
Forestiera acuminata	42.5	21.9	1.24	19.2	12.4	53.5
Fraxinus pensylvanica	30.0	15.5	0.48	7.4	24.8	47.7
Maclura pomifera	7.0	3.6	0.09	1.3	8.1	13.0
Sapindus Saponaria	5.0	2.6	0.14	2.2	0.4	5.2
Gleditsia triacanthos	2.0	1.0	0.03	0.5	1.0	2.5
Morus rubra	1.0	0.5	0.01	0.2	0.1	0.8
Ulmus americana**	0.5	0.3	0.01	0.1	***	0.4
Morus alba	0.5	0.3	0.01	0.1	***	0.4
Total	----	100.1	6.47	100.1	100.0	300.2

* Sum of relative frequency, relative density, and relative dominance.

** May include Ulmus rubra.

*** Value less than 0.1.

Table 16. Size classes (dbh) of plant species located in Community 7.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Celtis laevigata	579	42	16							
Ulmus crassifolia	176	53	13	9	2	1				
Forestiera acuminata	218	19	2							
Fraxinus pensylvanica	53	22	17		1	1	1			
Maclura pomifera	4	5	6	2						
Sapindus Saponaria	27	1								
Gleditsia triacanthos	3	2	1							
Morus rubra	1	1								
Ulmus americana*	1									
Morus alba	1									
Total	1063	145	55	11	3	2	1			

* May include Ulmus rubra.

Table 17. Frequency, density and dominance data for plant species located in Community 8.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Fraxinus pensylvanica	29.5	8.3	2.70	26.7	6.3	41.3
Ulmus crassifolia	42.0	11.8	0.83	8.2	16.9	36.9
Ilex decidua	51.5	14.5	1.68	16.6	2.0	33.1
Cornus Drummondii	43.5	12.2	1.99	19.7	0.9	32.8
Quercus Shumardii	6.5	1.8	0.08	0.7	14.1	16.6
Carya illinoinensis	8.5	2.4	0.10	1.0	11.3	14.7
Juniperus virginiana	23.0	6.5	0.34	3.3	3.8	13.6
Ulmus americana**	9.0	2.5	0.12	1.1	7.5	11.1
Maclura pomifera	8.0	2.3	0.12	1.2	6.0	9.5
Celtis laevigata	17.5	4.9	0.25	2.5	2.0	9.4
Others***		32.8	1.95	18.5	29.2	80.5
Total		100.0	10.15	99.5	100.0	299.5

* Sum of relative frequency, relative density and relative dominance.

** May include Ulmus rubra.

*** Other species present listed in order of decreasing importance values: Acer Negundo, Cercis canadensis, Populus deltoides, Quercus spp. (includes Quercus stellata and Quercus similis), Fraxinus americana, Morus rubra, Quercus macrocarpa, Sapindus

Table 17. (cont.)
Saponaria, Ulmus alata, Callicarpa americana, Diospyros virginiana, Viburnum rufidulum, Carya texana, Bumelia lanuginosa, Gleditsia triacanthos, Amorpha fruticosa, Prunus mexicana, Vitex Agnus-castus, Zanthoxylum Clava-Herculis, Rhamnus lanceolata.

Table 18. Size classes (dbh) of plant species located in Community 8.

Species	Size Classes (cm)								
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Fraxinus pensylvanica	531		4	2	2					
Ulmus crassifolia	107	40	15	3	1					
Ilex decidua	335									
Cornus Drummondii	397									
Quercus Shumardii	1		4	4	5		1			
Carya illinoinensis		1	13	6						
Juniperus virginiana	54	9	3		1					
Ulmus americana*	9	7	2	3	1	1				
Maclura pomifera	12	7	3	1		1				
Celtis laevigata	41	7	2							
Others**	336	19	12	7	2	2	1		1	
Total	1823	90	58	26	12	4	2		1	

*May include Ulmus rubra.

**See Table 17 for a list of other species present.

STUDY AREA 3

Introduction

Study Area 3 was located northwest of Rosser, Texas, in southwestern Kaufman County and in eastern Ellis County. The study sites, situated on both sides of the Trinity River, were south of the confluence of the river and its East Fork. Field analyses were accomplished during the spring of 1974.

Topographically, the study sites were flat with occasional sloughs or depressions. All were located in the flood plain between the levees and the river. Geologically, the area was composed of Alluvium deposits of Recent origin within the Quaternary Period. The soils were Trinity clay which is a soil subject to frequent flooding, has a very slow permeability and thus poor drainage. Because of its characteristics and setting, the Trinity clay soil is poorly suited for dwellings, local roads, cropland, septic tanks and intensive recreational use. It has fair suitability for wildlife, woodland and pasture (Meade, 1970). The study areas were forested while adjacent land, at least that which is protected by levees, is generally used for pasture and cropland.

Land Use

In 1970, Kaufman County had a population of 32,392 and a total annual income of $80,347,000 (Texas Almanac, 1971). In 1972, there were an estimated 34,000 residents with a total income of $95,166,000 (Texas Almanac, 1973). Mineral production, chiefly oil, stone and gas, yielded only about $2,828,000. On the average, farm income generates another $15 million annually, three-fourths of this from livestock and the remainder mostly from cotton and grain. Although many Kaufman County residents work in the Dallas metro area, the county does support some varied manufacturing enterprises of its own.

Only 23,950 acres of Kaufman County's total 511,916 acres were classified as non-commercial in 1967 (Table 19) (County Conservation Needs Inventory Committee, 1967). This was up from the 17,903 acres in 1958, due to relatively sizable increases both in urban and built-up and small water areas.

In the period between 1958 and 1967, cropland decreased sharply by almost 114,000 acres or about 44%, from 256,945 to 143,077 acres (Table 19). Most of this area has been converted to pasture, which increased over 132,000 acres

Table 19. Kaufman County and Ellis County land areas (in acres) (from Kaufman County Conservation Needs Inventory Committee, 1967, and Ellis County Conservation Needs Inventory Committee, 1970)

Land Use	Kaufman County 1958	Kaufman County 1967	Ellis County 1958	Ellis County 1967
Total land area	511,916	511,916	604,302	604,302
Less: Federal non-cropland	0	0	0	1,420
Less: Urban and built-up	16,963	22,515	28,110	29,594
Less: Small water areas	940	1,435	14,956	15,706
Total non-commercial area	17,903*	23,950	43,066*	46,720
Total commercial farm and forest area	502,850*	487,966	565,748*	557,582
Cropland	256,945	143,077	392,447	303,044
Pasture	157,339	289,737	144,427	175,669
Range	0	0	0	69,699
Forest	80,000	46,759	26,308	2,242
Other land	8,566	8,393	2,566	6,928

* The failure of these figures to conform to their respective totals is a result of discrepancy in the original data.

or about 86% from 157,339 to 289,737 acres. Woodlands, of little commercial value in Kaufman County, are being cleared. Forest acreage decreased from 80,000 acres in 1958 to 46,759 acres in 1967.

"Other land", which includes sites for non-urban residences and weekend homes, declined slightly from 8566 to 8393 acres between 1958 and 1967 (Table 19). This is in contrast to the marked acreage increase evidenced in most counties along the Trinity River. It may reflect Kaufman County's general lack of scenic rural homesites and the unfavorable engineering characteristics of its heavy clay soil.

An appraisal of potential for outdoor recreational developments (Anonymous, 1967c) considers Kaufman County as having limited outdoor recreational attractions. The greatest asset is its location only 30 miles from Dallas and 65 miles from Ft. Worth where large populations, enjoying slightly above average incomes, furnish a market for outdoor recreation. The county borders the northern tip of Cedar Creek Reservoir and contains two reservoirs of its own with a combined area of 1750 acres and 40 smaller lakes averaging 40 acres in size. Limiting factors are the hot summer climate, the limited scenic beauty, the lack of underground water over most of the county, and the heavy clay soils which are poorly drained and sticky following rains.

Small game hunting is the only significant outdoor recreational pursuit appraised as having high potential for development. Camping, picnicking and field sports, waterfowl hunting, riding stables, and golf courses are deemed as having only medium potential. Fishing and water sports are the most popular existing attractions but rate only medium potential along with vacation cabins and homesites due to crowded, heavy use of existing sites and a lack of remaining locations for water impoundments.

Ellis County has experienced a rapid growth rate in the last few years. A 1972 estimate placed the population at 50,900, up from 46,638 in 1970 and 43,395 in 1960 (Texas Almanac, 1971 and 1973). The total income is increasing as well, rising from $113,339,000 in 1970 to $155,149,000 in 1972. On the average, agriculture contributes $24 million annually, 60% of which is from crops, including cotton, sorghums, other grains, and pecans. Cattle, hogs, horses, poultry, and some sheep are also produced. Agribusiness is an important source of income, and the county boasts 25 gins, 15 grain elevators and 7 feedlots. Ellis County also has various manufacturing concerns.

Additionally, many of the county's residents are employed in Dallas.

Of Ellis County's total area of 604,302 acres, 46,720 were classified as non-commercial in 1967 (Table 19) (Ellis County Conservation Needs Inventory Committee, 1970). Of note is Bardwell Reservoir with 3,570 surface acres and the rather large figure of 15,706 acres in small water areas, 2 to 40 acres in size.

Over half, or 303,044 acres of the commercial land area of Ellis County was classified as cropland in 1967. This is down about 23% from the 1958 figure of 392,447 acres. Forest land declined from 26,308 acres to 2,242 acres between 1958 and 1967. Land lost from this usage is going into livestock production. Between 1958 and 1967, pasture increased from 144,427 to 175,669 acres, while range went from 0 to 69,699 acres. Range and pasture combined thus increased by 100,941 acres, or about 70%, during this time.

While urban and built-up land increased only moderately, from 28,110 acres in 1958 to 29,594 acres in 1967, the classification "other land" had a much greater increase both percentagewise and in actual area (from 2,566 to 6,928 acres). This was due chiefly to the great number of non-urban homes being built in the county prior to 1967. In addition, according to local Soil Conservation Service personnel, the last 4 or 5 years prior to 1974 have seen a tremendous growth in the number of non-agricultural small (5 to 10 acre) landowners. These observers feel that perhaps 1/5 of Ellis County has gone into rural developments catering to people from the Dallas-Fort Worth area.

An appraisal of potential for outdoor recreational development in Ellis County (Anonymous, 1967b) considers Ellis County's proximity to large population centers, the high average income in these urban centers and the county's abundant small reservoirs as elements favoring the development of outdoor recreational enterprises. A number of limiting factors exist, however, including the lack of scenic and natural areas, unfavorable soil properties and a lack of habitat for most game animals. The survey estimates that golf courses and shooting preserves have a high potential for development. Vacation cabins and homesites, camping, picnicking and field sport areas, fishing, small game hunting, scenic areas, riding stables and water sports areas rated only a medium potential. Low potential exists for development of natural and historic areas and for big game hunting.

Methods and Procedures

Three study communities were selected within Study Area 3. The location of each community and the position of study transects therein is shown in Figures 7 and 8. Two-hundred and two plots were analyzed in Community 9, 205 in Community 10, and 219 in Community 11 resulting in a total of 626 plots.

Description of Study Sites

Community 9 was located in Kaufman County near the confluence of Red Oak Creek and the Trinity River (Fig. 7). Two intermittant creeks transected the flat topography of this study site. Community 10 was situated northeast of Sand Lake which, in turn, is just northwest of Highway 34 (Fig. 8). The immediate topography of this study site was flat although sloughs, probably resulting from the building of levees, were present in the vicinity. Community 10 was in Ellis County as was Community 11. Community 11 was established near the junction of Highway 34 and the Trinity River. The topography was flat with an occasional depression. Although not evident in Community 9, it is likely that all study communities, at one time or another, were subjected to selective cutting.

Results

Community 9

The forest comprising Community 9 was dominated by Texas sugarberry (Celtis laevigata), green ash (Fraxinus pensylvanica) and cedar elm (Ulmus crassifolia) associated with occasional trees of soap-berry (Sapindus Saponaria) and red mulberry (Morus rubra) (Table 20). Other species were less common. A few fairly large trees were present, but most had dbh less than 40 cm (Table 21). Growth was somewhat dense with an average of about 13 trees or shrubs per plot. A total of 20 species were recorded in this community.

Community 10

Community 10 was also composed primarily of Texas sugarberry, cedar elm and green ash (Table 22). A rather unique feature of this community was the presence of large shrubby poison ivy (Rhus toxicodendron). Three-hundred forty-two plants with dbh greater than 1/2 cm were recorded causing poison ivy to be a codominant in the community (Table 23). Other somewhat abundant species were rough-leaf dogwood (Cornus Drummondii), soap-berry and deciduous

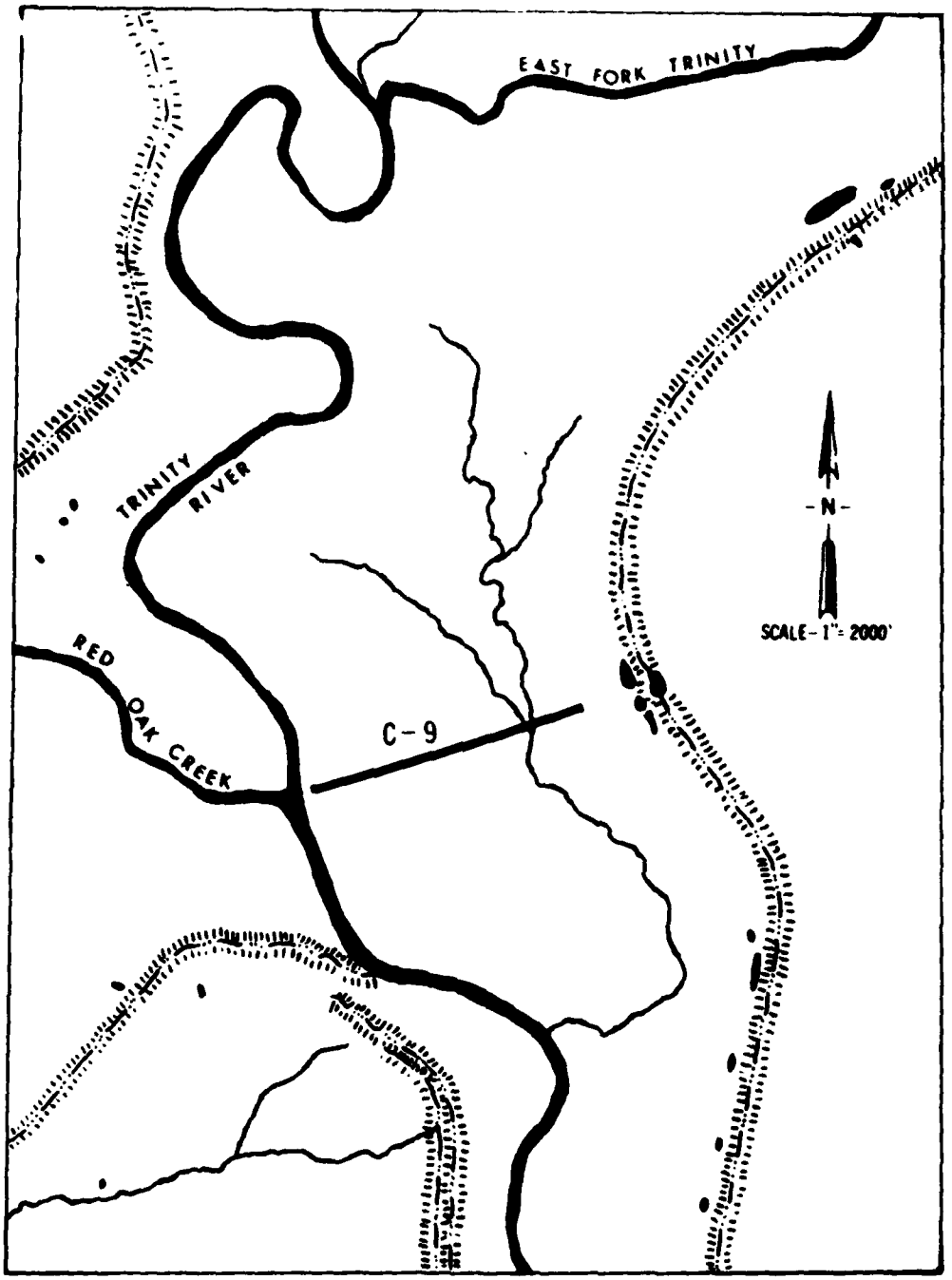


Fig. 7. Location of Community 9 (C-9) and position of study transect (solid line).

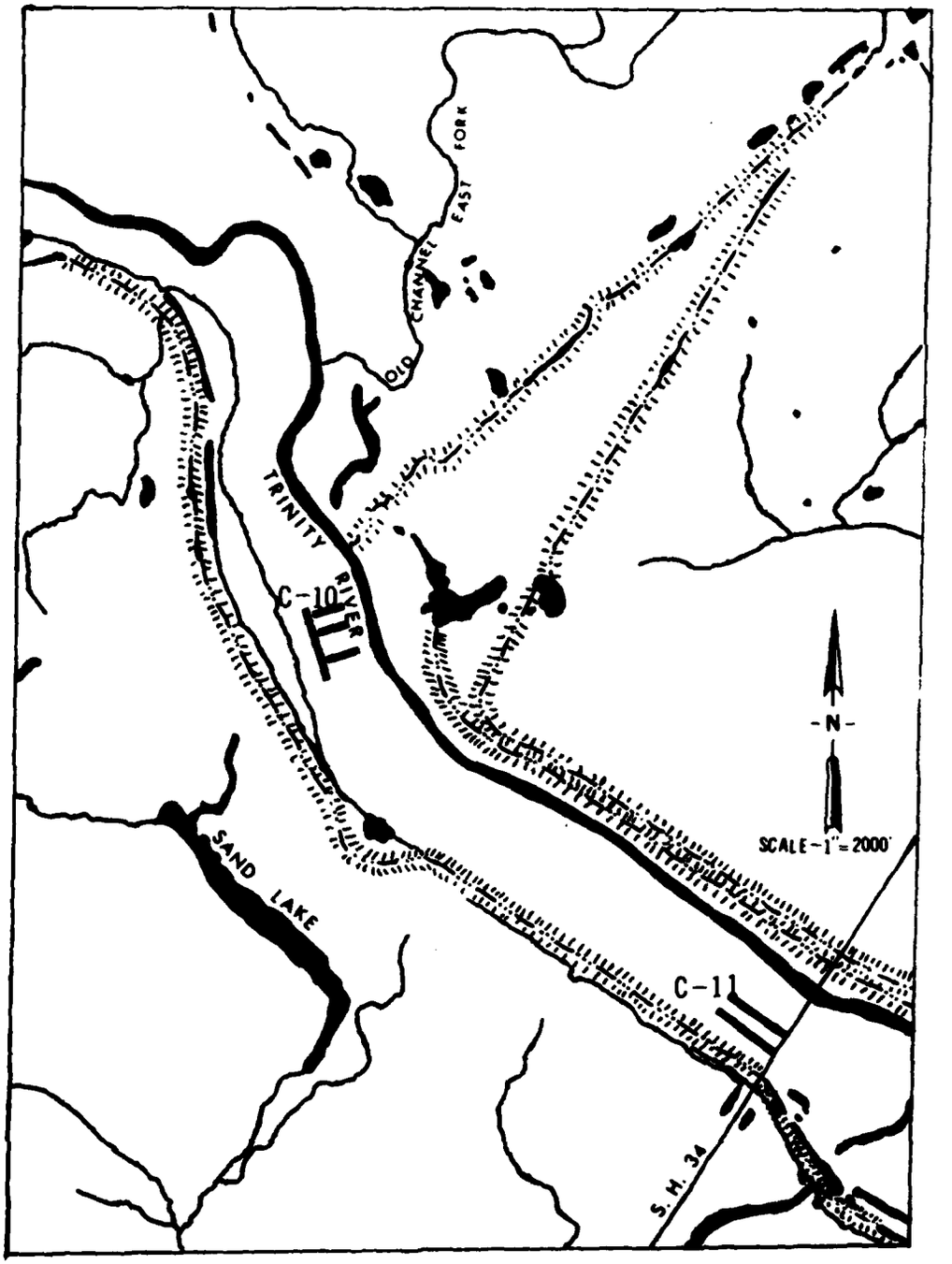


Fig. 8. Location of Communities 10 and 11 (C-10 and C-11) and position of study transects (solid lines).

Table 20. Frequency, density, and dominance data for plant species located in Community 9.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Celtis laevigata	63.9	18.0	5.61	43.3	17.2	78.5
Fraxinus pensylvanica	53.0	14.9	1.54	11.9	33.8	60.6
Ulmus crassifolia	68.3	19.2	1.89	14.5	26.6	60.3
Sapindus Saponaria	30.7	8.6	1.18	9.1	3.3	21.0
Morus rubra	42.1	11.9	0.74	5.7	3.0	20.6
Ilex decidua	24.3	6.8	0.55	4.2	1.2	12.2
Cornus Drummondii	13.4	3.8	0.45	3.4	0.3	7.5
Ulmus americana**	5.5	1.6	0.07	0.6	4.0	6.2
Crataegus spp.	10.4	2.9	0.11	0.9	1.5	5.3
Sophora affinis	11.9	3.3	0.24	1.8	0.1	5.2
Others***		9.1	0.56	4.5	9.0	22.6
Total	----	100.1	12.94	99.9	100.0	300.0

* Sum of relative frequency, relative density and relative dominance.

** May include Ulmus rubra.

*** Other species present listed in order of decreasing importance values: Forestiera acuminata, Fraxinus americana, Rhus toxicodendron, Maclura pomifera, Quercus macrocarpa, Populus deltoides, Quercus Shummardii, Bumelia languinosa, Acer Negundo, Gleditsia triacanthos.

Table 21. Size classes (dbh) of plant species located in Community 9.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Celtis laevigata	1052	53	27	2						
Fraxinus pensylvanica	183	69	45	11	3		1			
Ulmus crassifolia	251	98	18	8	3	3				
Sapindus Saponaria	214	20	4							
Morus rubra	135	13	2							
Ilex decidua	111									
Cornus Drummondii	90									
Ulmus americana*	7		6	1				1		
Crataegus spp.	15	6	2							
Sophora affinis	48									
Others**	91	13	4	4	3		1			
Total	2197	272	108	26	9	3	2	1		

* May include Ulmus rubra.

** See Table 20 for a list of other species present.

Table 22. Frequency, density, and dominance data for plant species located in Community 10.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Celtis laevigata	39.5	12.1	0.69	8.7	30.6	51.4
Ulmus crassifolia	48.3	14.7	1.05	13.3	21.9	49.9
Fraxinus pensylvanica	40.0	12.2	0.70	8.8	21.3	42.3
Rhus toxicodendron	31.7	9.7	1.67	21.1	0.2	31.0
Cornus Drummondii	32.7	10.0	1.46	18.5	1.1	29.6
Sapindus Saponaria	38.5	11.8	0.82	10.4	2.4	24.6
Ilex decidua	34.6	10.6	0.64	8.1	1.1	19.8
Quercus macrocarpa	9.8	3.0	0.10	1.3	8.0	12.3
Morus rubra	20.5	6.3	0.30	3.8	1.6	11.7
Sophora affinis	12.2	3.7	0.25	3.1	0.3	7.1
Others**	20.0	5.7	0.20	3.2	11.4	20.3
Total	----	99.8	7.88	100.3	99.9	300.0

* Sum of relative frequency, relative density and relative dominance.

** Other species present listed in decreasing order of importance values: Maclura pomifera, Carya illinoinensis, Quercus Shumardii, Ulmus americana (may include U. rubra), Crataegus spp., Bumelia languinosa, Populus deltoides, Prunus americana, Forestiera acuminata, Acer Negundo.

Table 23. Size classes (dbh) of plant species located in Community 10.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Celtis laevigata	35	62	32	12						
Ulmus crassifolia	133	57	22	3						
Fraxinus pensylvanica	66	51	23	4						
Rhus toxicodendron	342									
Cornus Drummondii	294									
Sapindus Saponaria	159	10								
Ilex decidua	130									
Quercus macrocarpa	8	6	4	1	1				1	
Morus rubra	53	9								
Sophora affinis	50	1								
Others*	28	10	3	2	3	1	1			
Total	1298	206	84	22	4	1	1		1	

* See Table 22 for a list of other species present.

holly (Ilex decidua). Almost all of the trees recorded had dbh less than 40 cm (Table 23). A total of 20 species were recorded.

Community 11

Three species dominated Community 11 (Table 24). Green ash was the principal species in association with cedar elm and Texas sugarberry. These same 3 species dominated Communities 9 and 10. A total of 18 species were recorded in Community 11 with an average of about 7 recorded plants per plot. Very few trees had dbh greater than 40 cm (Table 25).

Table 24. Frequency, density and dominance data for plant species located in Community 11.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Fraxinus pensylvanica	75.3	31.3	3.70	51.5	34.0	116.8
Ulmus crassifolia	62.6	26.0	1.68	23.5	35.9	85.4
Celtis laevigata	45.2	18.8	1.07	15.0	14.8	48.6
Carya illinoinensis	8.2	3.4	0.09	1.3	7.9	12.6
Ilex decidua	13.2	5.5	0.18	2.5	0.3	8.3
Maclura pomifera	7.8	3.2	0.08	1.2	2.7	7.1
Morus rubra	7.3	3.0	0.10	1.3	0.3	4.6
Diospyros virginiana	4.1	1.7	0.05	0.6	0.9	3.2
Crataegus spp.	4.1	1.7	0.04	0.6	0.3	2.6
Quercus macrocarpa	1.4	0.6	0.01	0.2	1.5	2.3
Others**		5.0	0.16	2.4	1.4	8.8
Total	----	100.2	7.16	100.1	100.0	300.3

* Sum of relative frequency, relative density and relative dominance.

** Other species present listed in order of decreasing importance values: Ulmus americana (may include Ulmus rubra), Sophora affinis, Cornus Drummondii, Sapindus Saponaria, Bumelia lanuginosa, Acer Negundo, Gleditsia triacanthos, Rhus toxicodendron.

Table 25. Size classes (dbh) of plant species located in Community 11.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Fraxinus pensylvanica	679	125	5	1	4					
Ulmus crassifolia	279	48	21	3						
Celtis laevigata	146	77	11							
Carya illinoinensis	7	1	5	6	1					
Ilex decidua	38									
Maclura pomifera	10	6	2							
Morus rubra	18	1								
Diospyros virginiana	8		2							
Crataegus spp.	8		1							
Quercus macrocarpa	1			2						
Others*	29	4	2							
Total	1223	262	49	12	5					

* See Table 24 for a list of other species present.

STUDY AREA 4A

Introduction

Study Area 4A was situated north of the junction of Highway 31 and the Trinity River in the vicinity of Tool, Texas. More specifically, it was located in Henderson County on the Bruce Smith Ranch and in Navarro County near the junction of the spillway from Cedar Creek Reservoir and the Trinity River. Field analyses in Study Area 4A were accomplished in the spring of 1974.

Topographically, the study sites were flat with occasional sloughs and depressions. Geologically, the area consists of Alluvium deposits of Recent origin within the Quaternary Period. The soils of the study communities in Study Area 4A were Trinity clay. Although fertile, this soil is so frequently flooded that cropland production is too uncertain to be practicable (Meade, 1970). Because of flooding and also the soil's slow permeability, poor drainage, high shrink-swell potential, and other characteristics, the Trinity Clay soil is not suited for dwellings, septic tanks, or intensive recreational use. It is fairly well suited for woodland and pasture.

Land Use

Study Area 4A was located in 2 counties, Henderson and Navarro. Because land use data for Navarro County is presented in connection with Study Area 5, it is not included here. Henderson County's estimated 27,900 people had a total annual income in 1972 of $76,930,000. Some $44,908,000 of this was derived from oil, gas, clays, sand and gravel. Agriculture contributed about $11 million. Cattle, hogs, horses and poultry were the source of over 90% of this agricultural sum, while other income was from crops including grain, fruits, vegetables and pecans. Additional income in the county was derived through manufacturing, agribusiness, recreation and timber.

In 1967, non-commercial land totaled 23,803 acres out of Henderson County's total of 603,264 acres (Table 26) (County Conservation Needs Inventory Committee, 1967). The increase from 1958's 20,602 acres was almost entirely due to the greater urban and built-up area in 1967.

Within the commercial land group, cropland declined in the same period from 186,942 to 42,888 acres (Table 26). This represented a decrease of over 144,000 acres or about 77%. A much slower decline was foreseen in 1958, when it was predicted that by 1975 there would be 90,280 acres of cropland in the county (County Conservation Needs

Table 26. Henderson County land area (in acres)
(from Henderson County Conservation Needs Inventory Committee, 1967)

Land Use	1958	1967
Total land area	601,600	603,264
Less: Federal non-cropland	0	0
Less: Urban and built-up	17,463	20,463
Less: Small water areas	3,139	3,340
Total non-commercial area	20,602*	23,803
Total commercial farm and forest area	578,609*	579,461
Cropland	186,942	42,888
Pasture	121,369	310,219
Forest	256,358	193,800
Other land	13,940	32,554

* The failure of these figures to conform to their total is a result of discrepancy in the original data.

Inventory Committee, 1958). At the same time, forest acreage dropped 24% from 256,358 to 193,800 acres, well over 62,000 acres. Most of the acreage lost by these two categories went into pasture land, the largest single land use in 1967. Pasture acreage increased from 121,369 to 310,219 acres. This amounted to a gain of nearly 189,000 acres or almost 154%.

Due to the great popularity of weekend homesites and rural residences around the lakes of the county, the category "other land" increased by almost 19,000 acres or about 133% from 13,940 to 32,554 acres (Table 26). This land use can only become more important in the future as urban residents seek recreation and relaxation outside of their cities.

Henderson County offers a number of attractions to outdoor recreation seekers (Finch, Bollinger and McLauchlin, 1967) and Dallas, Fort Worth, Tyler and Waco all lie within 50 to 150 miles of the county. Henderson County has attractive scenery, sandy soils which favor development, and an abundance of water impoundments. Cedar Creek Reservoir, Lake Athens, and Lake Palestine lie within the county or on its borders.

Water sports, fishing and picnicking have been appraised as having high potential for development (Finch, Bollinger and McLauchlin, 1967). Hunting, camping, riding stables, shooting preserves and golf courses are estimated to have medium development potential. Vacation cabins and homesites were rated as having medium potential for development in 1967. Demand for weekend and vacation homes seems to be constantly increasing, however, especially near water sports areas. In view of Henderson County's proximity to Dallas-Fort Worth, its many acres of water and shoreline, its scenic attractiveness, and the already heavy buying of land by Dallasites in less attractive counties closer to Dallas, it would seem that weekend homes will become more and more numerous and will constitute an increasingly important land use within the county.

Methods and Procedures

Three study communities (12, 13 and 14) represented Study Area 4A. The location of these communities and position of transects therein are presented in Figures 9 and 10. A total of 624 plots were analyzed with 204 in Community 12, 204 in Community 13 and 216 in Community 14.

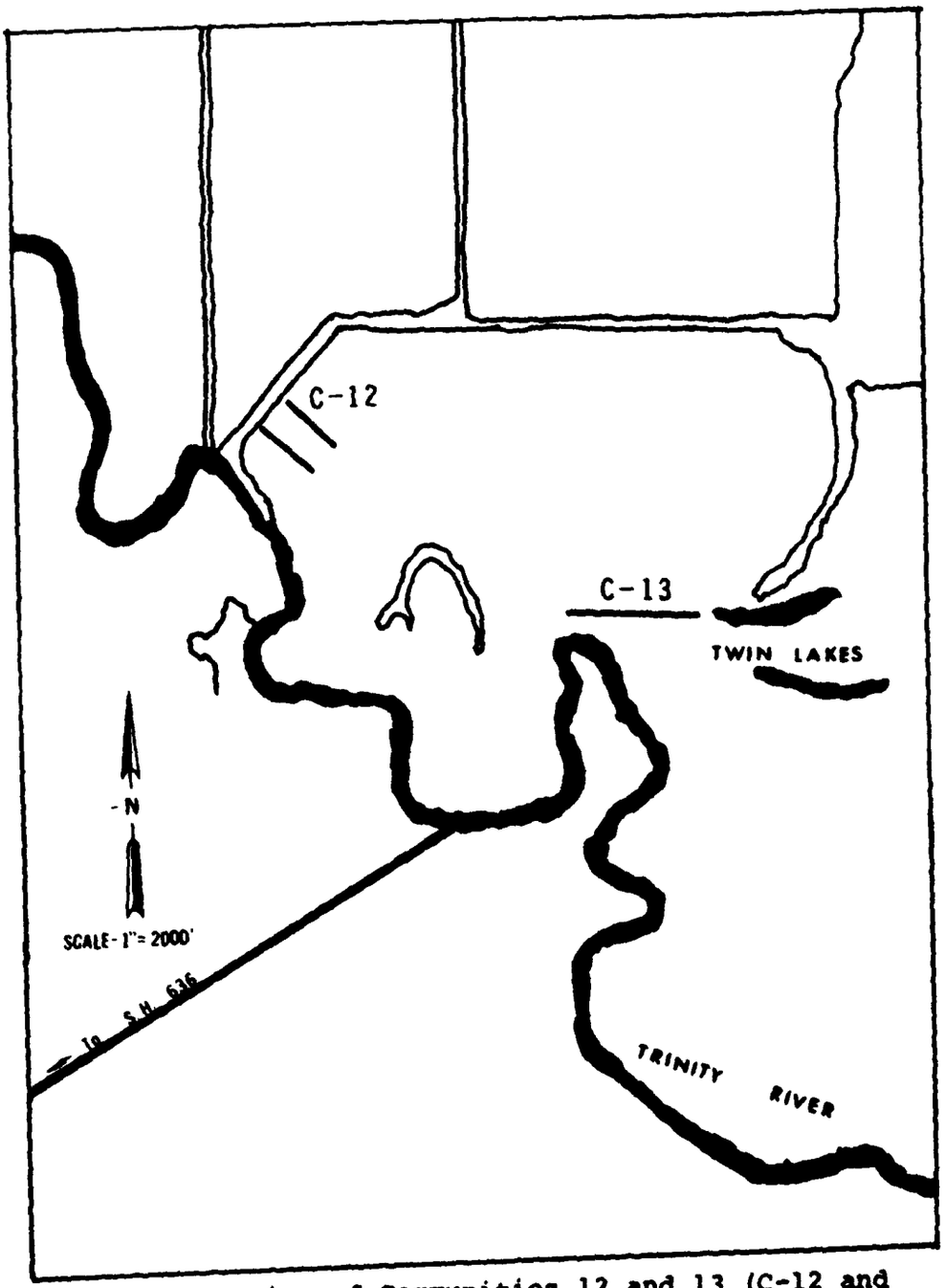


Fig. 9. Location of Communities 12 and 13 (C-12 and C-13) and position of study transects (solid lines).

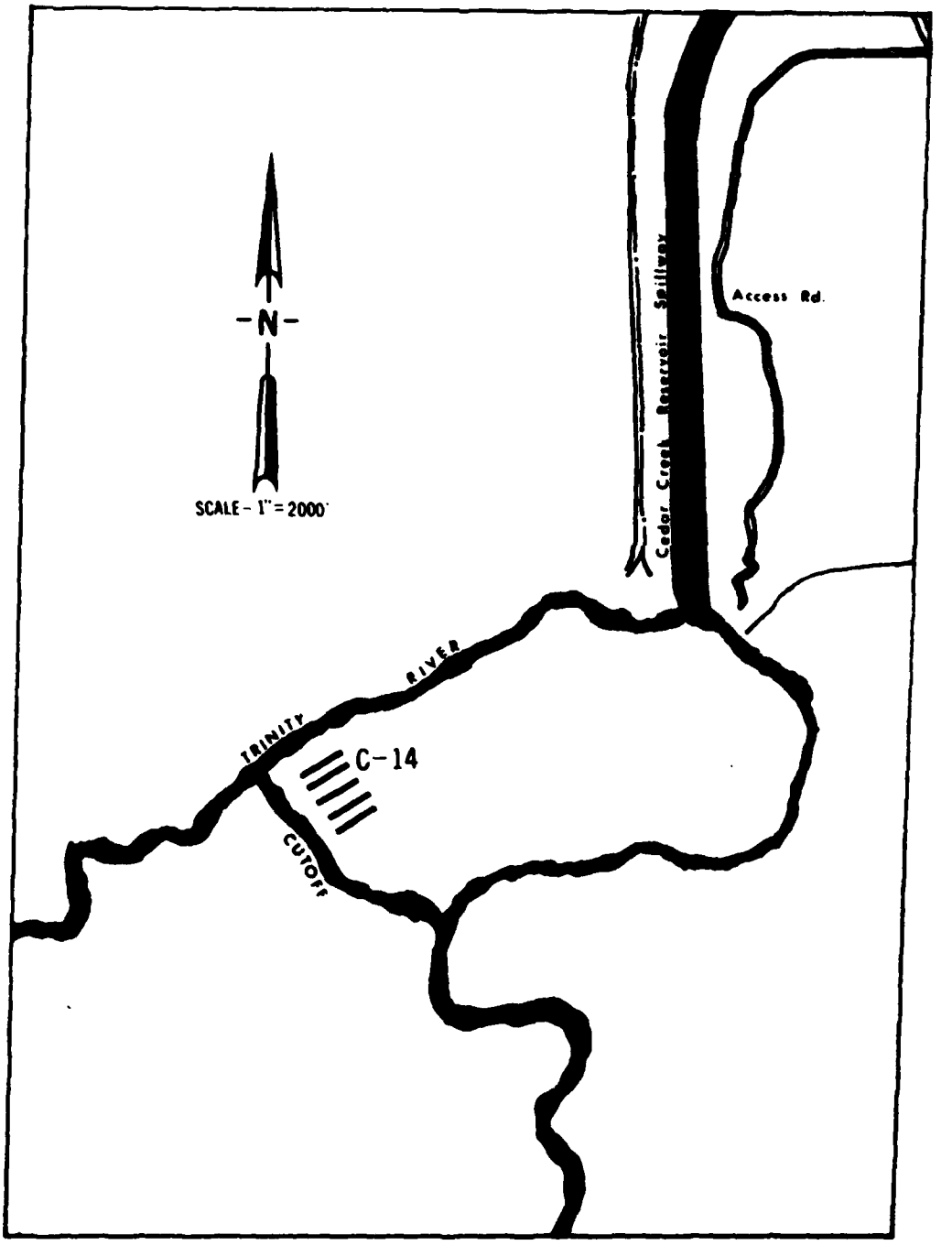


Fig. 10. Location of Community 14 (C-14) and position of study transect (solid line).

Description of Study Sites

Communities 12 and 13 were located in Henderson County just west and northwest of the Twin Lakes on the Bruce Smith Ranch (Fig. 9). These sites were both flat with an occasional depression or slough. The forests were generally open as a result of a sporadic shrub layer. Cattle grazed within these study sites and past selective cutting was evident. Community 14 was on a big bend of the Trinity River in Navarro County just southwest of the confluence of the Cedar Creek Reservoir spillway and the river (Fig. 10). Because of flooding, and water running through a cutoff (Fig. 10), cattle were not allowed to graze northeast of the cutoff. As a result of non-grazing in Community 14, grass and forbs were waist high. This community has been selectively cut in the past.

Results

Community 12

Cedar elm (Ulmus crassifolia) was the most frequent and abundant tree or shrub species recorded in Community 12 with Texas sugarberry (Celtis laevigata) and gum bumelia (Bumelia lanuginosa) being less prevalent (Table 27). Swamp privet (Forestiera acuminata) was common in slough areas. Little species diversity existed in this community, with only 9 species recorded. Trees were generally small and scattered with most having dbh less than 40 cm (Table 28). There were only 1.46 plants per plot.

Community 13

Community 13 was composed primarily of cedar elm associated with occasional trees of green ash (Fraxinus pensylvanica) and soap-berry (Sapindus Saponaria) (Table 29). Because transects crossed a rather extensive slough, swamp privet was the second dominant species. Trees were scattered with only 1.47 trees per plot being recorded. Only 10 species were recorded in Community 13 and with the exception of cedar elm, diameters of trees were generally less than 40 cm (Table 30).

Community 14

Principal species in Community 14 were cedar elm, hawthorn (Crataegus spp.), green ash and Texas sugarberry (Table 31). Swamp privet, found in a swampy depression, and roughleaf dogwood (Cornus Drummondii) were less frequent. A greater species diversity existed within

Table 27. Frequency, density and dominance data for plant species located in Community 12.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Ulmus crassifolia	42.6	51.8	0.55	37.7	74.5	164.0
Celtis laevigata	14.2	17.3	0.39	26.9	8.9	53.1
Bumelia lanuginosa	6.9	8.3	0.20	13.5	3.3	25.1
Crataegus spp.	5.9	7.1	0.11	7.4	2.9	17.4
Fraxinus pensylvanica	3.9	4.8	0.04	2.7	5.8	13.3
Forestiera acuminata	3.4	4.2	0.10	6.7	0.9	11.8
Sapindus Saponaria	2.5	3.0	0.04	2.7	3.5	9.2
Gleditsia triacanthos	2.0	2.4	0.02	1.3	0.1	3.8
Ilex decidua	1.0	1.2	0.01	1.0	**	2.2
Total		100.1	1.46	99.9	99.9	299.9

* Sum of relative frequency, relative density and relative dominance.

** Less than 0.1.

Table 28. Size classes (dbh) of plant species located in Community 12.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Ulmus crassifolia	9	29	42	22	9		1			
Celtis laevigata	67	5	5	4						
Bumelia languinosa	34	3	3							
Crataegus spp.	15	5	2							
Fraxinus pensylvanica	3		1	3	1					
Forestiera acuminata	19	1								
Sapindus Saponaria	3	1	3	1						
Gleditsia triacanthos	4									
Ilex decidua	3									
Total	157	44	56	30	10		1			

Table 29. Frequency, density and dominance data for plant species located in Community 13.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Ulmus crassifolia	39.7	51.3	0.59	40.1	75.7	167.1
Forestiera acuminata	14.7	19.0	0.57	38.4	10.2	67.6
Fraxinus pensylvanica	6.9	8.9	0.07	5.0	8.2	22.1
Sapindus Saponaria	7.4	9.5	0.10	6.6	3.3	19.4
Bumelia lanuginosa	2.9	3.8	0.06	4.0	1.7	9.5
Celtis laevigata	1.5	1.9	0.04	2.6	**	4.5
Crataegus spp.	2.0	2.5	0.02	1.3	0.3	4.1
Gleditsia triacanthos	1.5	1.9	0.02	1.3	0.4	3.6
Sophora affinis	0.5	0.6	***	0.3	0.2	1.1
Diospyros virginiana	0.5	0.6	***	0.3	**	0.9
Total	----	100.0	1.47	99.9	100.0	299.9

* Sum of relative frequency, relative density and relative dominance.

** Less than 0.1.

*** Less than 0.01.

Table 30. Size classes (dbh) of plant species located in Community 13.

Species	Size Classes (cm)								
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Ulmus crassifolia	5	21	39	32	20	3	1			
Forestiera acuminata	95	21								
Fraxinus pensylvanica		3	4	7	1					
Sapindus Saponaria	5	8	7							
Bumelia lanuginosa	7	2	2	1						
Celtis laevigata	8									
Crataegus spp.	3	1								
Gleditsia triacanthos	2	1	1							
Sophora affinis		1								
Diospyros virginiana	1									
Total	126	58	53	40	21	3	1			

Table 31. Frequency, density, and dominance data for plant species located in Community 14.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Ulmus crassifolia	29.6	13.7	0.40	8.6	48.3	70.6
Crataegus spp.	38.0	17.5	0.97	20.7	19.6	57.8
Fraxinus pensylvanica	41.2	19.0	0.89	18.9	5.3	43.2
Celtis laevigata	34.7	16.0	0.50	10.7	16.5	43.2
Cornus Drummondii	18.1	8.3	0.45	9.6	0.8	18.7
Forestiera acuminata	11.1	5.1	0.45	9.7	3.4	18.2
Ilex decidua	9.7	4.5	0.36	7.7	1.1	13.3
Bumelia lanuginosa	8.3	3.8	0.19	4.1	1.0	8.9
Sapindus Saponaria	8.3	3.8	0.14	3.1	0.8	7.7
Rhus toxicodendron	6.5	3.0	0.18	3.8	**	6.8
Others***	11.2	5.1	0.13	3.1	3.1	11.3
Total	----	99.8	4.66	100.0	99.9	299.7

* Sum of relative frequency, relative density and relative dominance.

** Less than 0.1.

*** Other species present listed in order of decreasing importance values: Morus rubra, Sophora affinis, Quercus macrocarpa, Gleditsia triacanthos, Maclura pomifera.

Community 14 than was found in Communities 12 and 13, as evidenced by the recording of 15 species. There were 4.66 trees or shrubs per plot and they were generally small (dbh less than 40 cm) (Table 32).

Table 32. Size classes (dbh) of plant species located in Community 14.

Species	Size Classes (cm)								
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Ulmus crassifolia	20	12	27	18	10					
Crataegus spp.	155	44	9	1						
Fraxinus pensylvanica	185	3	1	3						
Celtis laevigata	79	9	11	10						
Cornus Drummondii	96	1								
Forestiera acuminata	96	1								
Ilex decidua	71									
Bumelia lanuginosa	40	1	1							
Sapindus Saponaria	28	3								
Rhus toxicodendron	39									
Others *	26	2		3						
Total	835	76	49	35	10					

* See Table 31 for a list of other species present.

STUDY AREA 4B

Introduction

Study Area 4B was in southeastern Henderson County on the Stephens Lake Ranch. Although normally a part of the floodplain of the Trinity River, the area at present is protected by a levee. Field analyses were made during the spring of 1974.

The topography of the study sites was flat with occasional sloughs or depressions. Geologically the area contains Alluvium and Fluviatile terrace deposits, of Recent and Pleistocene origin, respectively, within the Quaternary Period. The soils were Kaufman clay, Wrightsville and the Axtell-Wrightsville complex (U. S. Department of Agriculture, unpublished data).

The Kaufman soil is a somewhat poorly drained, very slowly permeable bottomland black clay occurring on level to gently sloping floodplains. Because of Kaufman clay's liability to flooding, high shrink-swell potential and wetness, it is poorly suited for dwellings, septic tanks, local roads and most recreation uses. It has good suitability for woodland and for woodland wildlife. If it were not for the flood hazard aspect, this soil could be productive for cropland and improved pasture.

The Wrightsville is a level, poorly drained, very slowly permeable soil consisting of silt loam over silty clay. The soil is seasonally saturated with water. The Wrightsville soil, because of its wetness, slow permeability and high shrink-swell potential, has severe limitations for dwellings, local roads and developed recreational uses. It has fair suitability for woodland and cropland use. It is suitable for wetland wildlife and has a fairly good suitability for improved pasture.

The Axtell-Wrightsville complex consists of closely associated pockets of the Wrightsville soil, described above, and the Axtell soil. The Axtell soil has a fine sandy loam surface with clay below 6 inches. Limitations are the high shrink-swell potential and the low permeability which cause the soil to be poorly suited for dwellings, septic tanks, local roads and camp and play areas. It has only fair suitability for cropland and is not considered a commercial woodland site. Good potential exists for rangeland wildlife. Production potential is medium to high for improved pasture.

Land use information for Henderson County was presented in connection with Study Area 4A and, therefore, will not be repeated in this section. Much of the land surrounding Study Area 4B has been cleared for pasture and cropland and the study area itself is grazed by livestock. It is likely that selective timber cuttings have been made within the study area in the past but many large trees are still present.

Methods and Procedures

Three study sites were representative of Study Area 4B. The location of each site and the position of transects therein is presented in Figure 11. There were 402 plots analyzed in the 3 study sites with 168 located in Community 15, 134 in Community 16 and 100 in Community 17.

Description of Study Sites

Community 15 was located just southwest of Long Lake on the Kaufman clay soil (Fig. 11). The site was flat with an occasional depression or intermittant creek. Communities 16 and 17 were situated directly east of Long Lake (Fig. 11). These sites probably contained an intermingling of both the Wrightsville and Axtell-Wrightsville complex soils. The topography is flat with some slightly elevated and better-drained sites.

Results

Community 15

Community 15 consisted chiefly of cedar elm (Ulmus crassifolia), Texas sugarberry (Celtis laevigata) and green ash (Fraxinus pensylvanica) associated with deciduous holly (Ilex decidua), hawthorn (Crataegus spp.) and honey locust (Gleditsia triacanthos) (Table 33). The community had a fairly good species diversity, with 21 species being recorded, and a medium density, with about 7 trees or shrubs per plot (Table 33). Although a few large trees were present, most had dbh less than 40 cm (Table 34).

Community 16

Community 16 generally displayed a two-layered physiognomy with post oak (Quercus stellata), white ash (Fraxinus americana), cedar elm and Texas sugarberry comprising the upper canopy and deciduous holly, hawthorn and transgressives of the upper canopy forming a shrub

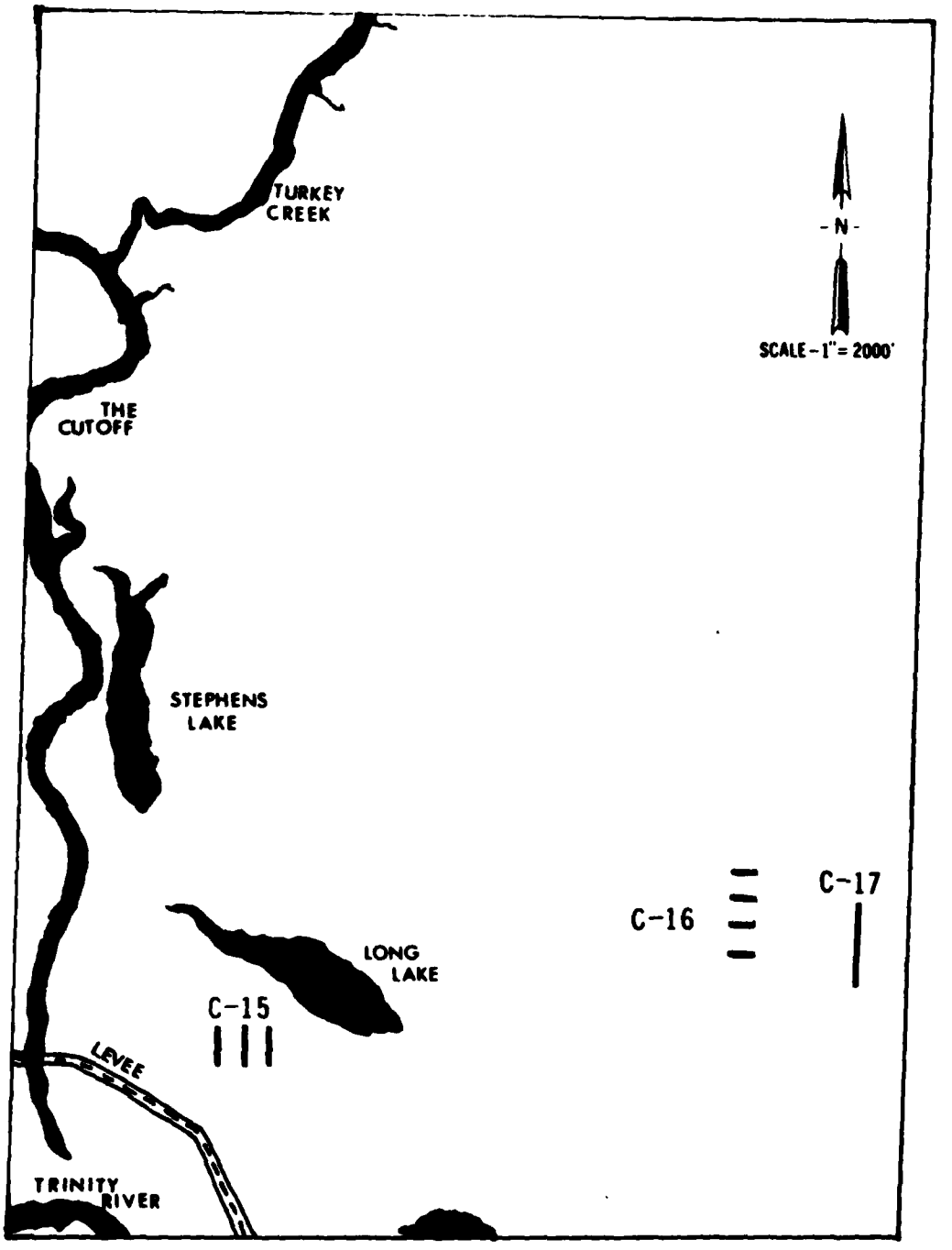


Fig. 11. Location of Communities 15, 16 and 17 (C-15, C-16 and C-17) and position of study transects (solid lines).

Table 33. Frequency, density and dominance data for plant species located in Community 15.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Ulmus crassifolia	34.5	12.5	0.48	6.6	45.3	64.4
Celtis laevigata	55.4	20.0	1.73	24.0	8.8	52.8
Fraxinus pensylvanica	38.7	14.0	1.57	21.9	11.8	47.7
Ilex decidua	38.7	14.0	1.13	15.7	1.2	30.9
Crataegus spp.	35.7	12.9	0.71	9.9	4.7	27.5
Gleditsia triacanthos	25.6	9.2	0.58	8.1	0.8	18.1
Sapindus Saponaria	9.5	3.4	0.15	2.1	3.3	8.8
Quercus stellata	2.4	0.9	0.02	0.3	7.2	8.4
Bumelia lanuginosa	7.7	2.8	0.26	3.6	1.7	8.1
Quercus Shumardii	1.2	0.4	0.01	0.2	6.3	6.9
Others**		10.1	0.55	7.5	8.9	26.5
Total	----	100.2	7.19	99.9	100.0	300.1

* Sum of relative frequency, relative density and relative dominance.

** Other species present listed in order of decreasing importance values: Quercus lyrata, Cornus Drummondii, Forestiera acuminata, Sophora affinis, Fraxinus americana, Carya illinoinensis, Morus rubra, Ulmus americana (may include U. rubra), Cercis canadensis, Rhus toxicodendron, Tilia americana (includes T. caroliniana and T. floridana).

Table 34. Size classes (dbh) of plant species located in Community 15.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Ulmus crassifolia	24	19	18	13	6					
Celtis laevigata	278	5	5	1	1					
Fraxinus pensylvanica	256		4	3	1					
Ilex decidua	189									
Crataegus spp.	110	10								
Gleditsia triacanthos	98									
Sapindus Saponaria	17	5	3							
Quercus stellata			1	2		1				
Bumelia lanuginosa	42	1	1							
Quercus Shumardii						2				
Others*	85	4		1				1		
Total	1099	44	32	20	8	3		1		

* See Table 33 for a list of other species present.

to mid-layer (Table 35). The occurrence of post oak and other more upland species such as southern blackhaw (Viburnum rufidulum) and redbud (Cercis canadensis) is apparently the result of the more sandy, elevated and better drained soils of this site. Because this is a bottomland site, the possibility of these post oak trees being bottomland post oak (Quercus similis) cannot be overlooked, but characteristics favored post oak. Diameters of trees in the community were generally less than 50 cm in dbh but some larger trees were present (Table 36). There were 8.5 woody plants per plot and a total of 28 species in Community 16.

Community 17

Cedar elm was by far the dominant species in Community 17 (Table 37). Other prevalent species were bottomland post oak, white ash and deciduous holly. Eighteen species were recorded at this site with an average of 4.52 plants per plot. Some large trees were present but most had dbh less than 40 cm (Table 38).

Table 35. Frequency, density, and dominance data for plant species located in Community 16.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Quercus stellata	35.8	9.6	1.05	12.4	31.9	53.9
Fraxinus americana	52.2	14.0	1.34	15.8	24.0	53.8
Ilex decidua	71.6	19.2	2.57	30.2	1.3	50.7
Ulmus crassifolia	36.6	9.8	0.50	5.9	23.8	39.5
Celtis laevigata	35.1	9.4	0.99	11.7	1.1	22.2
Crataegus spp.	28.4	7.6	0.51	6.0	0.8	14.4
Quercus Phellos	20.9	5.6	0.28	3.3	2.1	11.0
Quercus nigra	14.2	3.8	0.28	3.2	2.3	9.3
Bumelia lanuginosa	15.7	4.2	0.22	2.5	0.1	6.8
Quercus lyrata	4.5	1.2	0.05	0.6	4.6	6.4
Others**		15.6	0.71	8.6	7.9	32.1
Total	----	100.0	8.50	100.2	99.9	300.1

* Sum of relative frequency, relative density and relative dominance.

** Other species present listed in order of decreasing importance value: Sapindus Saponaria, Quercus Shumardii, Carya illinoinensis, Viburnum rufidulum, Cercis canadensis, Quercus macrocarpa, Prunus mexicana, Ulmus alata, Crataegus spathulata, Gleditsia tricanthos, Quercus velutina, Quercus similis, Morus rubra, Ulmus americana (may include U. rubra), Crataegus Marshallii, Diospyros virginiana, Fraxinus pensylvanica, Sophora affinis.

Table 36. Size classes (dbh) of plant species located in Community 16.

Species	Size Classes (cm)								
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Quercus stellata	105	19	8	3	3		2		1	
Fraxinus americana	142	13	15	9	1					
Ilex decidua	345									
Ulmus crassifolia	18	32	8	7	2					
Celtis laevigata	130	3								
Crataegus spp.	68									
Quercus Phellos	37				1					
Quercus nigra	36				1					
Bumelia lanuginosa	29									
Quercus lyrata	4		1		1	1				
Others*	85	6	2	1	2					
Total	999	73	34	20	11	1	2		1	

* See Table 35 for a list of other species present.

Table 37. Frequency, density, and dominance data for plant species located in Community 17.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Ulmus crassifolia	58.0	21.6	0.95	21.0	52.9	95.5
Quercus similis	25.0	9.3	0.63	13.9	27.8	51.0
Fraxinus americana	44.0	16.4	0.83	18.4	9.5	44.3
Ilex decidua	45.0	16.8	0.77	17.0	0.3	34.1
Celtis laevigata	18.0	6.7	0.39	8.6	0.1	15.4
Quercus Phellos	11.0	4.1	0.11	2.4	6.1	12.6
Bumelia lanuginosa	18.0	6.7	0.19	4.2	0.1	11.0
Crataegus spp.	12.0	4.5	0.19	4.2	0.3	9.0
Gleditsia triacanthos	12.0	4.5	0.16	3.5	0.5	8.5
Sapindus Saponaria	9.0	3.4	0.10	2.2	2.3	7.9
Others**		5.9	0.20	4.3	0.1	10.3
Total	----	99.9	4.52	99.7	100.0	299.6

* Sum of relative frequency, relative density and relative dominance.

** Other species present listed in order of decreasing importance values: Prunus mexicana, Quercus stellata, Viburnum rufidulum, Ulmus alata, Juniperus virginiana, Sophora affinis, Quercus lyrata, Diospyros virginiana.

Table 38. Size classes (dbh) of plant species located in Community 17.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Ulmus crassifolia	6	60	24	4	1					
Quercus similis	54	3	1	1	1		2	1		
Fraxinus americana	76		3	4						
Ilex decidua	77									
Celtis laevigata	39									
Quercus Phellos	9				2					
Bumelia lanuginosa	19									
Crataegus spp.	19									
Gleditsia triacanthos	14	2								
Sapindus saponaria	5	4	1							
Others*	20									
Total	338	69	29	9	4		2	1		

* See Table 37 for a list of other species present.

STUDY AREA 5

Introduction

Study Area 5 was situated on the floodplain of Richland Creek in south-central Navarro County west of the Trinity River. More exactly, it was located south of the junction of the Chicago, Burlington, Rock Island and Pacific Railroad and Richland Creek at an elevation of about 295 feet above sea level. Field data were collected in the spring of 1973.

The immediate sites had a flat topography intersected by several smaller creeks and drainages. Geologically, the area was composed of Alluvium deposits of Recent origin within the Quaternary Period. Trinity Clay comprised the soil of the study area. The soil, because of its frequent flooding, is poorly suited for dwellings or intensive recreational use. It is well suited for pond reservoir areas, and has fair suitability for wildlife, woodland and pasture or range (U. S. Department of Agriculture, unpublished data).

The study sites are forested whereas surrounding, more elevated areas have been cleared for pasture. Cattle grazed within the study area.

Land Use

Navarro County had a 1970 population of 31,150, down from the 1960 population of 34,423 (Texas Almanac, 1971). Over half of the county's population (19,972 inhabitants) lived in Corsicana, the largest town and the county seat. Some 4500 more people lived in smaller towns of less than 1,000 inhabitants. The economy of the county is based chiefly on agribusiness, industry, and oil. Of the county's $82,430,000 total income, $14,500,000 was farm income. Eighty percent of this was derived from beef cattle and poultry, while grain sorghums, cotton and hay were the leading crops.

Only about 6% (39,865 acres) of the county's total 695,488 acres were classified as non-commerical (Table 39) (Navarro County Conservation Needs Committee, 1967). Between 1958 and 1967 about 10,000 acres changed from commercial to the non-commercial classification, chiefly due to the acquisition of about 8500 acres by the Federal government. In this same period, there was an approximately 42% (over 225,000 acres) decline in cropland acreage. Forestland area in this period declined from

Table 39. Navarro County land area (in acres).
(from Navarro County Conservation Needs Committee, 1967.)

Land Use	1958	1967
Total land area*	693,760	695,488
Less: Federal non-cropland	0	8,492
Less: Urban and built-up	21,873	22,973
Less: Small water areas	7,900	8,400
Total non-commercial area	29,773	39,865
Total commercial farm and forest area	663,987	655,623
Cropland	524,049**	298,545**
Pasture	27,199**	314,671**
Range	8,565**	27,989**
Forest	110,119**	38,591**
Other land	2,620**	3,816**

* The acreage difference in total land area is due to a different system of measuring land use by the Bureau of the Census. Total land area excludes water areas over 40 acres in size.

** The failure of these figures to conform to their respective totals is a result of the discrepancies in the original data.

over 110,000 acres to less than 39,000, a drop of about 71,400 acres or almost 65%. At the same time, the classification "other land" increased by 1200 acres from 2,620 to 3,816 acres. Pasture, however, made striking gains, increasing from a relatively small acreage of 27,199 acres in 1958 to 314,671 acres in 1967, an increase of about 287,500 acres or approximately 1157%. Rangeland acreage also increased from 8,565 acres in 1958 to 27,989 by 1967, up some 19,400 acres or about 325%. In 1967, pasture and rangeland together made up about 49% of Navarro County's total land area.

An appraisal of potential for outdoor recreational developments (Anonymous, 1967e) concluded that Navarro County offers moderate attractions to recreation seekers. An asset is the county's location within an hour's drive of both Dallas and Waco. Unfavorable factors include a hot summer climate, the relatively small area of woodland and wildlife habitat, and the heavy clay soils which make offpavement access almost impossible after heavy rains.

Due to the presence of a number of reservoirs and flood control impoundments, fishing headed the list of potential recreational pursuits with a high medium rating. Medium potential was seen for vacation cabins and homesites, camping grounds, picnicking and field sports, standard and par-3 golf courses, small game hunting, scenic and historic areas, vacation farms, and water sports areas.

Navarro County cannot offer the quality of recreation that draws visitors to Polk, San Jacinto, and Liberty counties along the lower Trinity River. According to local residents, however, Dallasites are buying land for vacation homes in Navarro County and land prices have risen noticeably as a result.

Methods and Procedures

Three study sites comprised Study Area 5. The more undisturbed plant communities representing the woody vegetation of the area were selected for analysis. Positions of transects are presented in Figure 12. A total of 700 plots (5 meters square) were analyzed, 300 in Community 18 and 200 each in Communities 19 and 20.

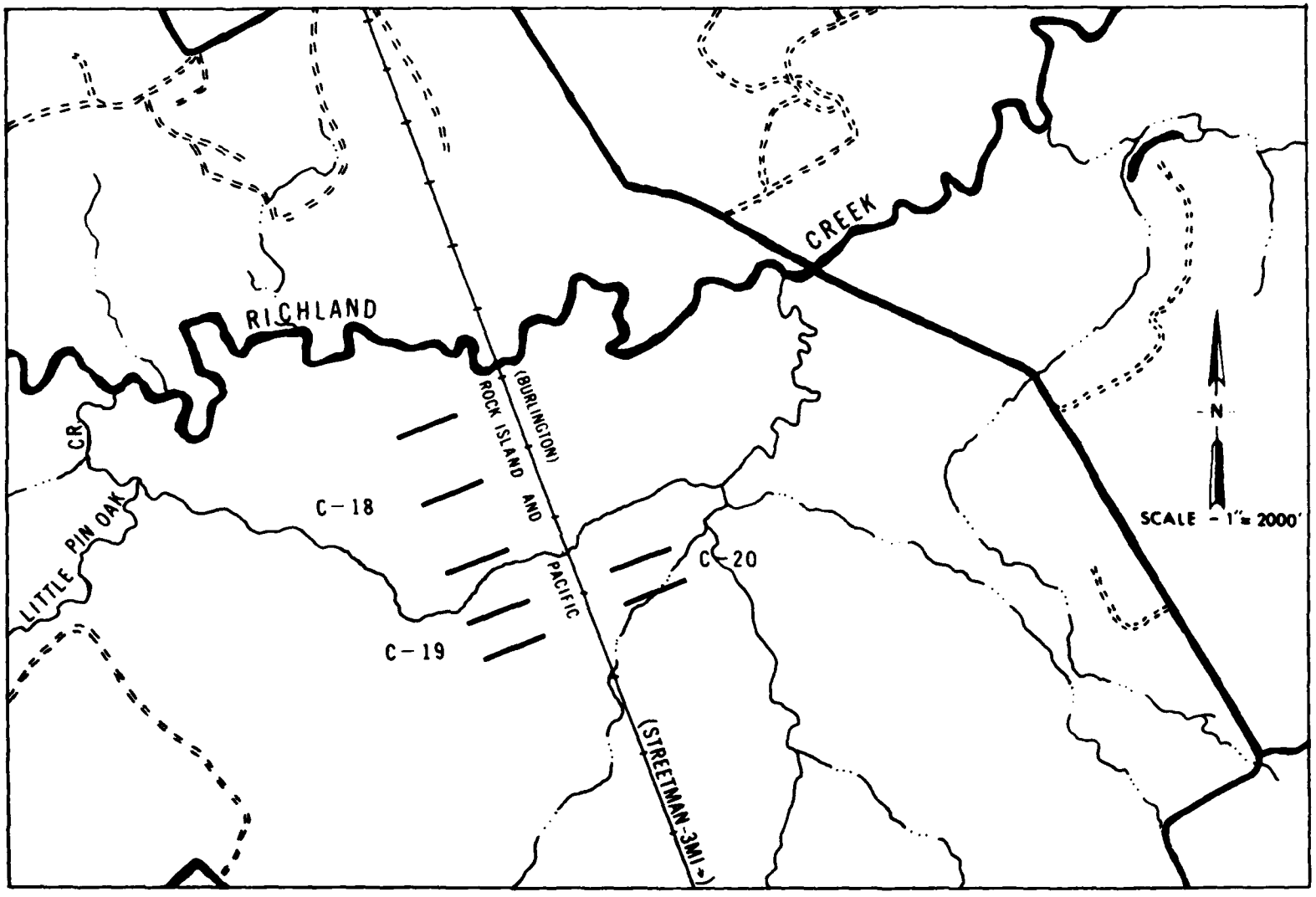


Fig. 12. Location of Communities 18, 19 and 20 (C-18, C-19 and C-20) and position of study transects (solid lines).

Description of Study Sites

All three study sites were located on a flat floodplain subject to occasional overflow. Moving water 1 to 2 feet deep covered the entire Study Area when sampling was begun but receeded within 4 or 5 days. Flooding is controlled to an extent by the Navarro Mills Reservoir on upper Richland Creek. Selective cutting of large trees, mainly bur oak (Quercus macrocarpa), for barrel staves about 25 or 30 years ago represents the latest logging operation.

Community 18 was located west of the railroad tracks and south of Richland Creek (Fig.12). Water stands in occasional depressions following flooding. Community 19 was characterized by the presence of a shallow swamp as well as somewhat better drained areas with an occasional wet depression. This community was located across a small creek south of Community 18 (Fig. 12). Community 20 was east of the railroad tracks opposite Community 19 (Fig. 12). It had water standing in depressions and was transected by an intermittant creek.

Results

Community 18

Only eleven woody plant species were recorded at Community 18. This forest contained a preponderance of Texas sugarberry (Celtis laevigata) associated with occasional trees of cedar elm (Ulmus crassifolia) (Table 40). Green ash (Fraxinus pensylvanica) and swamp privet (Forestiera acuminata) were mostly confined to wet locations. Probably as a result of flooding and grazing, the forest showed comparatively little regeneration with most species having fewer trees in the 1-10 cm size class (Table 41). Only occasional trees of cedar elm, green ash and bur oak had diameters at breast height greater than 40 cm. The shrub layer was generally lacking, allowing for a good growth of herbaceous plants. Ground cover was mostly wild rye (Elymus spp.) and wild onion (Allium spp.).

Community 19

At Community 19, Texas sugarberry was still by far the dominant species (Table 42). Cedar elm was only occasionally observed. Green ash and swamp privet were common in the wetter areas. Only nine woody species were recorded at Community 19. Wild rye and wild onion were prevalent as a result of an open understory. The forest

Table 40. Frequency, density and dominance data for plant species located in Community 18.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Celtis laevigata	61.3	62.0	1.00	60.4	65.8	188.2
Ulmus crassifolia	11.7	11.8	0.13	7.8	20.2	39.8
Forestiera acuminata	4.3	4.4	0.24	14.5	1.1	20.0
Fraxinus pensylvanica	5.0	5.1	0.08	4.6	4.7	14.4
Bumelia lanuginosa	5.7	5.7	0.08	5.0	2.8	13.5
Sapindus Saponaria	3.3	3.4	0.04	2.6	1.3	7.3
Crataegus spp.	3.7	3.7	0.04	2.2	0.5	6.4
Fraxinus americana	2.3	2.4	0.02	1.4	1.8	5.6
Quercus macrocarpa	0.7	0.7	0.01	0.4	1.6	2.7
Morus rubra	0.7	0.7	0.01	0.4	0.1	1.2
Gleditsia triacanthos	0.3	0.3	**	0.2	***	0.5
Total	----	100.2	1.65	99.5	99.9	299.6

* Sum of relative frequency, relative density, and relative dominance.

** Value less than 0.01.

*** Value less than 0.1.

Table 41. Size classes (dbh) of plant species located in Community 18.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Celtis laevigata	24	154	107	17						
Ulmus crassifolia	2	4	12	16	5					
Forestiera acuminata	71	1								
Fraxinus pensylvanica	6	11	4	1	1					
Bumelia lanuginosa	12	7	6							
Sapindus Saponaria	4	7	2							
Crataegus spp.	6	5								
Fraxinus americana		3	3	1						
Quercus macrocarpa				1	1					
Morus rubra	1	1								
Gleditsia triacanthos	1									
Total	127	193	134	36	7					

Table 42. Frequency, density and dominance data for plant species located at Community 19.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Celtis laevigata	68.0	55.1	1.40	58.9	61.4	175.4
Fraxinus pensylvanica	24.5	19.8	0.44	18.4	21.4	59.6
Ulmus crassifolia	12.5	10.1	0.17	7.2	10.4	27.7
Forestiera acuminata	6.5	5.3	0.25	10.3	0.8	16.4
Bumelia lanuginosa	5.5	4.5	0.06	2.5	1.4	8.4
Quercus macrocarpa	2.5	2.0	0.03	1.1	3.6	6.7
Sapindus Saponaria	2.0	1.6	0.02	0.8	0.6	3.0
Crataegus spp.	1.5	1.2	0.02	0.6	0.4	2.2
Gleditsia triacanthos	0.5	0.4	0.01	0.2	**	0.6
Total	----	100.0	2.40	100.0	100.0	300.0

* Sum of relative frequency, relative density, and relative dominance.

** Value less than 0.1.

was composed mostly of medium-sized trees in the 11-20 and 21-30 cm size classes (Table 43). Tree density was low as indicated by the presence of only 2.4 trees per plot.

Community 20

Community 20 was somewhat more open than Communities 18 and 19. Only 1.16 trees were recorded per plot (Table 44). Twelve woody species were recorded in this study site. Texas sugarberry was the dominant species but less strongly so than in the other two sites. Cedar elm and green ash were relatively more abundant (Table 44). Wild rye and wild onion comprised most of the ground cover. Most trees present were of medium size (Table 45).

Table 43. Size classes (dbh) of plant species located in Community 19.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Celtis laevigata	24	160	81	14						
Fraxinus pensylvanica	34	19	21	11	2					
Ulmus crassifolia	6	12	10	6						
Forestiera acuminata	47	2								
Bumelia lanuginosa	4	7	1							
Quercus macrocarpa				5						
Sapindus Saponaria	1	2	1							
Crataegus spp.	1	2								
Gleditsia triacanthos	1									
Total	118	204	114	36	2					

Table 44. Frequency, density and dominance data for plant species located in Community 20.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Celtis laevigata	30.0	34.7	0.45	39.8	37.3	111.8
Ulmus crassifolia	20.0	23.1	0.23	19.9	29.7	72.7
Fraxinus pensylvanica	16.5	19.1	0.22	19.5	17.6	56.2
Bumelia lanuginosa	6.5	7.5	0.08	7.1	4.5	19.1
Quercus macrocarpa	2.0	2.3	0.02	1.8	7.7	11.8
Crataegus spp.	3.5	4.0	0.05	4.4	1.9	10.3
Gleditsia triacanthos	3.5	4.0	0.04	3.5	0.1	7.6
Morus rubra	1.5	1.7	0.02	1.3	0.8	3.8
Maclura pomifera	1.5	1.7	0.02	1.3	0.4	3.4
Sapindus Saponaria	0.5	0.6	0.01	0.4	**	1.0
Others***		1.2	0.02	0.8	**	2.0
Total	----	99.9	1.16	99.8	100.0	299.7

* Sum of relative frequency, relative density, and relative dominance.

** Value less than 0.1.

*** Other species present listed in order of decreasing importance values: Ilex decidua, Forestiera acuminata.

Table 45. Size classes (dbh) of plant species located in Community 20.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Celtis laevigata	5	48	27	10						
Ulmus crassifolia	2	15	12	13	3					
Fraxinus pensylvanica	2	21	20	1						
Bumelia lanuginosa	6	4	6							
Quercus macrocarpa		1		1		2				
Crataegus spp.	6	3	1							
Gleditsia triacanthos	8									
Morus rubra	1	1	1							
Maclura pomifera	1	2								
Sapindus Saponaria	1									
Others*	2									
Total	34	95	67	25	3	2				

* See Table 44 for a list of other species present.

STUDY AREA 6A

Introduction

Study Area 6A consisted of a tract of forest about 7500 acres in size known as "The Hardwood Forest". This forest was located in Anderson County north of the junction of Highways 79 and 84 and the Trinity River in the vicinity of Big Lake. Field analyses were done during the spring of 1974.

The area displayed a rather flat topography with occasional sloughs and depressions. Geologically it is composed of Alluvium deposits of Recent origin within the Quaternary Period.

Soils in the vicinity of Study Area 6A consist primarily of Trinity Clay and Kaufman Clay. These soils are alluvial, frequently flooded, slowly permeable, poorly drained and have a fine, sticky texture and a high shrink-swell potential. The major difference is that sediments from which the Trinity Clay is formed were derived from calcareous parent material, while the Kaufman Clay is of noncalcareous origin. Both of these soils are fertile and produce excellent yields, but frequent flooding makes use for cropland too uncertain to be feasible (Meade, 1970). Due to the flood hazard and the properties of these soils, they are also unsuitable for dwellings, septic tanks, local roads, and intensive recreational use. They are well suited for wildlife and have fair suitability for woodland and pasture.

Land Use

Anderson County witnessed a slight decrease in population between 1960 and 1970, declining from 28,162 residents to 27,789 (Texas Almanac, 1971). However, the population increased to an estimated 29,100 by 1972 (Texas Almanac, 1973). The county's largest source of income is minerals, chiefly petroleum, salt and lignite, which contributed $44,908,000 of the 1972 total income of $69,305,000. Farm income amounted to only about $8.8 million annually, 80% from livestock and the remainder from such crops as grains and peanuts. Other income is derived chiefly from manufacturing, agribusiness and tourism.

Less than 5% (32,588 acres) of Anderson County's 686,272 acres of total area were classified as noncommercial in 1967 (Table 46) (Anderson County Conservation Needs Committee, 1967). This is up 10,000 acres from 1958, mainly as a result of the increased urban and built-up area.

Table 46. Anderson County land area (in acres)
(from Anderson County Conservation Needs Inventory Committee, 1967)

Land Use	1958	1967
Total land area	686,272	686,272
Less: Federal non-cropland	0	0
Less: Urban and built-up	18,713	28,278
Less: Small water areas	3,880	4,310
Total non-commercial area	22,593*	32,588
Total commercial farm and forest area*	660,137*	653,684
Cropland	95,798	64,260*
Pasture	160,262	183,196*
Range	280	0*
Forest	394,907	389,500*
Other land	8,890	16,733*

* The failure of these figures to conform to their respective totals is a result of discrepancies in the original data.

In the 20 years following 1940, cotton acreage in the county dropped from 43,534 acres to less than 3,000 acres (Anderson-Houston Soil and Water Conservation District, 1965). Row farming remained an important land use, however, and in 1958 cropland acreage still stood at 95,798 acres. This figure declined to 64,260 acres by 1967 (Anderson County Conservation Needs Committee, 1967). Although this amounted to a decrease of about 1/3, the trend away from row farming was not nearly so dramatic as that experienced by nearby Henderson, Navarro and Leon counties in the same period.

Anderson County also differed from these neighboring counties in having over 56% (389,500 acres) of its area in forests in 1967. Especially notable was the comparatively minute decrease of only about 5,000 acres from the 1958 total of 394,907 acres.

Pastureland in Anderson County did not exhibit the remarkable increase in acreage experienced by most other counties along the Trinity River. Anderson County had 160,262 acres of pasture plus 280 acres of range in 1958, substantially more than Henderson, Navarro or Leon counties. This total increased moderately by about 23,000 acres, or roughly 15%, to 183,196 acres of pasture (but no range) by 1967. During this same period, Henderson County's pastureland increased almost 154%, Navarro County's approximately 1157%, and Leon County's over 300%.

The catagory "other land" almost doubled from 8,890 acres in 1958 to 16,773 acres in 1967. This reflects growing usage of non-urban land for non-farm residences, weekend homes, lakehouses, etc. Percentagewise, this land use category was the most rapidly changing in Anderson County, which exhibited a much more stable pattern of land use than was found in most other East Texas counties.

Methods and Procedures

Five study sites were selected in Study Area 6A (Communities 21, 22,23, 24 and 25). The location of these communities and the position of study transects therein, is presented in Figure 13. A total of 974 plots were analyzed in Study Area 6A with 277 analyzed in Community 21, 123 in Community 22, 230 in Community 23, 190 in Community 24 and 154 in Community 25.

Description of Study Sites

Community 21 was located west of the northern part of Big Lake (Fig. 13). The topography was flat and the

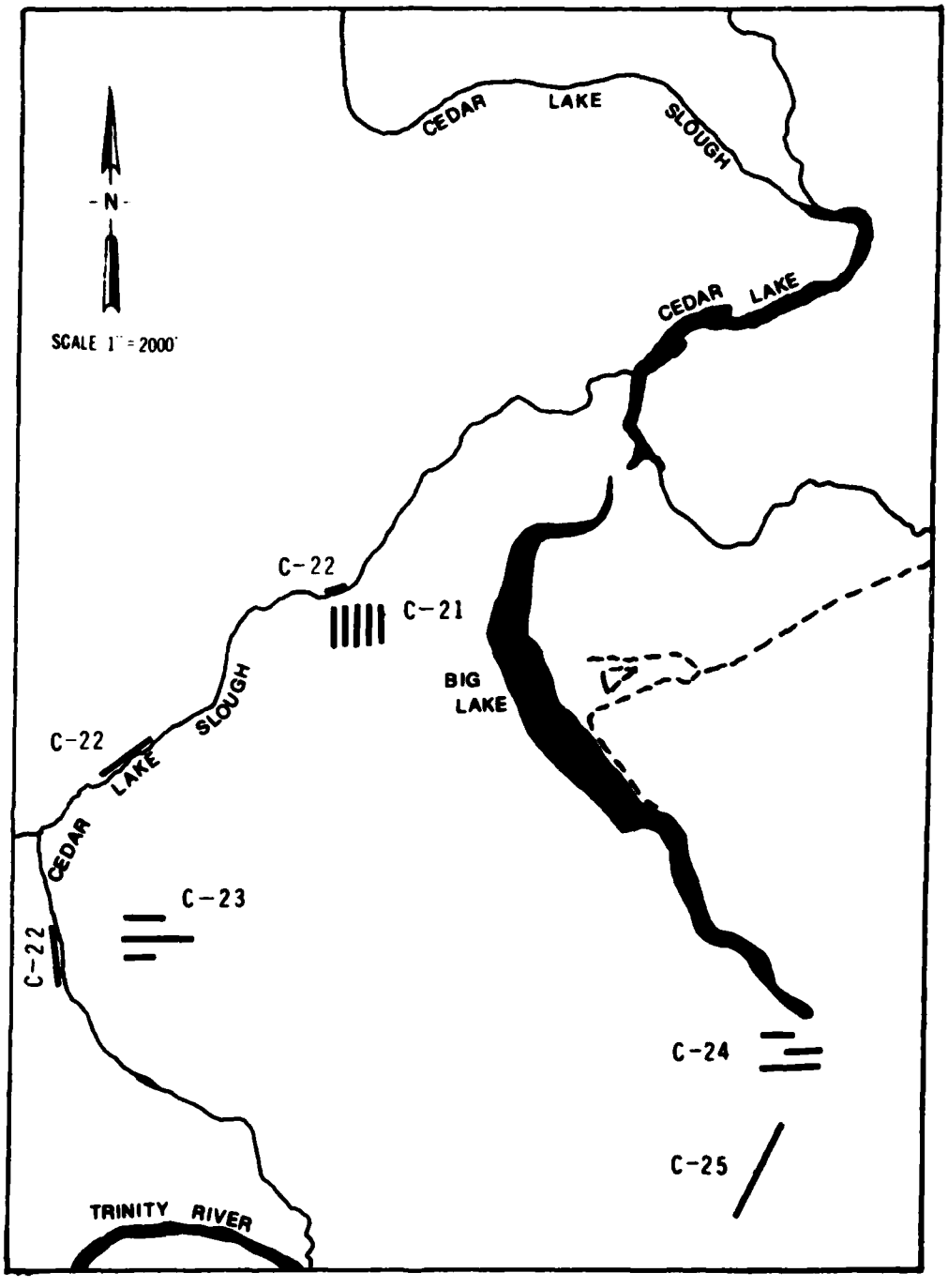


Fig. 13. Location of Communities 21, 22, 23, 24 and 25 (C-21, C-22, C-23, C-24 and C-25) and position of study transects (solid lines).

soil type was a Kaufman Clay. Transects were positioned in Cedar Lake Slough and represented Community 22 (Fig. 13). Water was intermittant and, as a result, plots were located only in wet portions of the slough. The soil of the slough was Trinity Clay. Community 23 was situated west of Big Lake near Cedar Lake Slough (Fig. 13). This study site was flat and contained a Kaufman Clay soil. Communities 24 and 25 were located just south of Big Lake (Fig. 13). Sloughs and depressions were more frequent and the communities, therefore, were more hydric. The soils of Community 24 were probably both Trinity Clay and Kaufman Clay whereas Community 25 contained Kaufman Clay. The forest is grazed by livestock and has been selectively cut in the past.

Results

Community 21

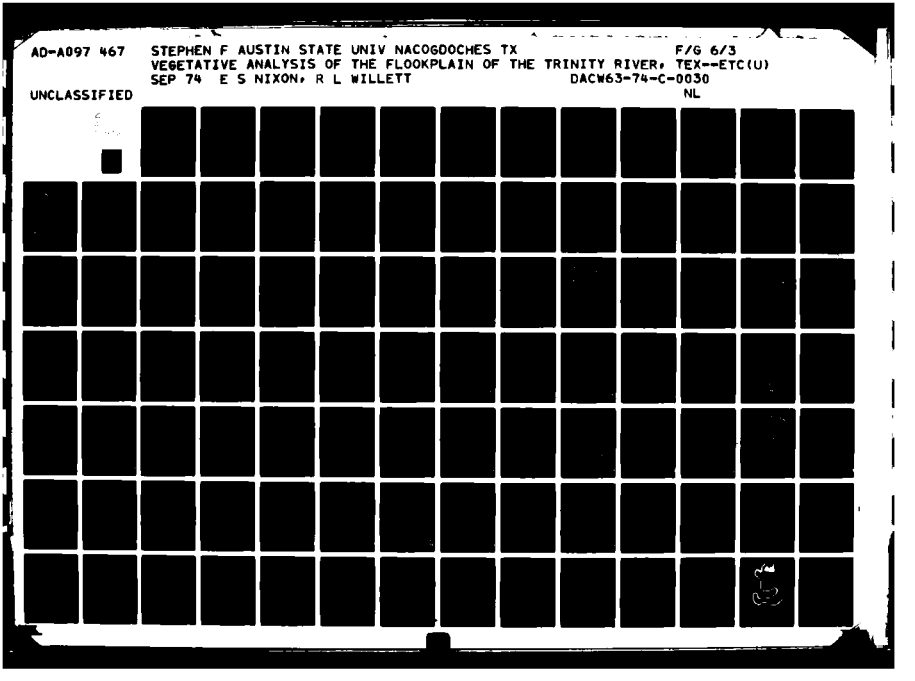
Community 21 was a two-layered community with cedar elm (Ulmus crassifolia), Texas sugarberry (Celtis laevigata) and willow oak (Quercus Phellos) comprising the upper canopy and hawthorn (Crataegus spp.) and deciduous holly (Ilex decidua) the subcanopy (Table 47). It was a fairly open community with only an average of about 2 plants per plot recorded. There were 17 species reported in Community 21 and representatives were all generally small in size (dbh less than 40 cm) (Table 48).

Community 22

The slough vegetation in Community 22 was composed primarily of swamp privet (Forestiera acuminata) and water locust (Gleditsia aquatica) (Table 49). Green ash (Fraxinus pensylvanica), common buttonbush (Cephalanthus occidentalis), cedar elm and overcup oak (Quercus lyrata) were also somewhat prevalent. Only 13 species were recorded in this community but the density was fairly good (7.76 plants per plot). There were a few large trees present but most had dbh less than 40 cm (Table 50).

Community 23

Community 23 consisted chiefly of cedar elm in association with Texas sugarberry, deciduous holly and hawthorn (Table 51). The community was generally open with only an average of 3 trees or shrubs per plot. The upper canopy was comprised mostly of cedar elm and Texas sugarberry; whereas the subcanopy was dominated by deciduous holly and hawthorn. Nineteen species were recorded in Community 23 and most had dbh less than 40 cm (Table 52).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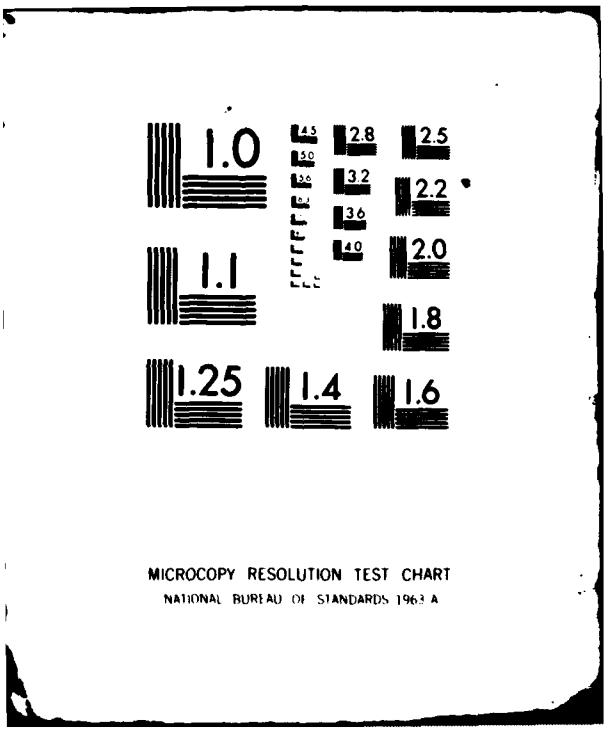
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Table 47. Frequency, density and dominance data for plant species located in Community 21.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Ulmus crassifolia	41.9	35.9	0.65	29.9	66.7	132.5
Crataegus spp.	28.5	24.5	0.78	36.2	7.6	68.3
Ilex decidua	14.8	12.7	0.33	15.4	0.6	28.7
Celtis laevigata	13.4	11.5	0.15	7.0	7.1	25.6
Quercus Phellos	6.1	5.3	0.08	3.5	12.5	21.3
Quercus lyrata	2.5	2.2	0.03	1.2	3.4	6.8
Bumelia lanuginosa	2.2	1.9	0.05	2.2	0.2	4.3
Gleditsia triacanthos	2.2	1.9	0.03	1.5	0.1	3.5
Sophora affinis	1.1	0.9	0.01	0.7	0.1	1.7
Cornus Drummondii	0.7	0.6	0.02	0.8	**	1.4
Others***		2.7	0.02	1.8	1.7	6.2
Total	----	100.1	2.15	100.2	100.0	300.3

* Sum of relative frequency, relative density and relative dominance.

** Value less than 0.1.

*** Other species present listed in decreasing order of importance values: Sapindus Saponaria, Diospyros virginiana, Ulmus americana (may include U. rubra), Fraxinus americana, Carya illinoinensis, Quercus similis, Planera aquatica.

Table 48. Size classes (dbh) of plant species located in Community 21.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Ulmus crassifolia	19	63	59	36	2					
Crataegus spp.	193	21	2	1						
Ilex decidua	91	1								
Celtis laevigata	18	11	12	1						
Quercus Phellos	1	2	7	11						
Quercus lyrata		2	3	1	1					
Bumelia lanuginosa	13									
Gleditsia triacanthos	8	1								
Sophora affinis	4									
Cornus Drummondii	5									
Others*	3	4	3							
Total	355	105	86	50	3					

* See Table 47 for a list of other species present.

Table 49. Frequency, density and dominance data for plant species located in Community 22.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Forestiera acuminata	59.3	28.7	3.93	50.6	14.3	93.6
Gleditsia aquatica	59.3	28.7	2.13	27.5	30.3	86.5
Fraxinus pensylvanica	24.4	11.8	0.36	4.6	18.8	35.2
Cephalanthus occidentalis	25.2	12.2	0.80	10.4	3.0	25.6
Ulmus crassifolia	13.0	6.3	0.16	2.1	15.6	24.0
Quercus lyrata	4.7	2.0	0.04	0.5	12.8	15.3
Planera aquatica	7.3	3.5	0.13	1.7	1.7	6.9
Celtis laevigata	5.7	2.8	0.07	0.8	3.0	6.6
Ilex decidua	4.1	2.0	0.09	1.2	0.1	3.3
Crataegus spp.	1.6	0.8	0.02	0.3	0.3	1.4
Others**		1.2	0.03	0.3	0.2	1.7
Total	----	100.0	7.76	100.0	100.1	300.1

* Sum of relative frequency, relative density and relative dominance.

** Other species present listed in decreasing order of importance values: Diospyros virginiana, Salix nigra, Carya illinoinensis.

Table 50. Size classes (dbh) of plant species located in Community 22.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Forestiera acuminata	481	2								
Gleditsia aquatica	222	26	6	5	2	1				
Fraxinus pensylvanica	26	8	2	5	2	1				
Cephalanthus occidentalis	98	1								
Ulmus crassifolia	1	6	4	9						
Quercus lyrata	1	1			1	1			1	
Planera aquatica	12	4								
Celtis laevigata	3	2	2	1						
Ilex decidua	11									
Crataegus spp.	2	1								
Others*	2	1								
Total	859	52	14	20	5	3			1	

* See Table 49 for a list of other species present.

Table 51. Frequency, density and dominance data for plant species located in Community 23.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Ulmus crassifolia	41.7	28.9	0.88	28.1	47.9	104.9
Celtis laevigata	26.5	18.4	0.42	13.4	23.0	54.8
Ilex decidua	26.0	18.0	0.80	25.7	3.4	47.1
Crataegus spp.	23.5	16.3	0.48	15.2	8.3	39.8
Cornus Drummondii	4.3	3.0	0.30	9.7	0.5	13.2
Quercus Phellos	2.6	1.8	0.03	0.8	5.3	7.9
Fraxinus americana	1.7	1.2	0.03	0.8	2.5	4.5
Quercus similis	1.3	0.9	0.01	0.4	3.0	4.3
Bumelia lanuginosa	3.0	2.1	0.03	1.0	0.7	3.8
Sapindus Saponaria	2.2	1.5	0.03	1.0	0.6	3.1
Others**		8.1	0.10	3.8	4.8	16.7
Total	----	100.2	3.11	99.9	100.0	300.1

* Sum of relative frequency, relative density and relative dominance.

** Other species present listed in order of decreasing importance values: Gleditsia aquatica, Gleditsia triacanthos, Ulmus americana (may include U. rubra), Quercus lyrata, Morus rubra, Diospyros virginiana, Carya illinoinensis, Fraxinus pensylvanica, Carya aquatica, Sophora affinis, Rhus toxicodendron.

Table 52. Size classes (dbh) of plant species located in Community 23.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Ulmus crassifolia	98	55	34	13	2					
Celtis laevigata	30	44	23	1						
Ilex decidua	185									
Crataegus spp.	81	27	2							
Cornus Drummondii	70									
Quercus Phellos	1		1	3	1					
Fraxinus americana		3	3							
Quercus similis	1			1	1					
Bumelia lanuginosa	5	1	1							
Sapindus Saponaria	4	3								
Others*	19	4	3	1	1					
Total	494	137	67	19	5					

* See Table 51 for a list of other species present.

Community 24

Community 24 had a more even mixture of dominant species than the other communities in Study Area 6A. Cedar elm, overcup oak, green ash and American elm (Ulmus americana) were frequent upper canopy species whereas deciduous holly, roughleaf dogwood (Cornus Drummondii) and hawthorn were principal subcanopy species (Table 53). A total of 23 species were recorded and the community had a good overall size class distribution (Table 54). The community was fairly open with only 4 plants per plot recorded.

Community 25

Trees were less dense (1.84 trees and shrubs per plot) and smaller in Community 25 when compared to Community 24 (Tables 55 and 56). Green ash was the dominant species in association with overcup oak, cedar elm and Texas sugarberry (Table 55). Swamp privet, deciduous holly and water hickory were also prevalent. Fifteen species were recorded in Community 25.

Table 53. Frequency, density and dominance data for plant species located in Community 24.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Ulmus crassifolia	42.6	20.9	0.67	16.6	10.7	48.2
Quercus lyrata	14.2	7.0	0.15	3.8	32.8	43.6
Fraxinus pensylvanica	21.6	10.6	0.66	16.3	13.0	39.9
Ilex decidua	23.7	11.7	0.61	14.9	0.6	27.2
Ulmus americana**	15.3	7.5	0.18	4.6	12.8	24.9
Cornus Drummondii	13.7	6.7	0.62	15.2	0.8	22.7
Crataegus spp.	20.0	9.8	0.44	10.8	1.5	22.1
Carya aquatica	10.5	5.2	0.13	3.1	9.3	17.6
Celtis laevigata	13.7	6.7	0.23	5.6	3.3	15.6
Quercus Phellos	6.3	3.1	0.07	1.8	7.5	12.4
Others***		11.1	0.33	7.5	8.0	26.6
Total	----	100.3	4.09	100.2	100.3	300.8

* Sum of relative frequency, relative density and relative dominance.

** May include Ulmus rubra.

*** Other species present listed in order of decreasing importance values: Carya illinoinensis, Diospyros virginiana, Gleditsia triacanthos, Morus rubra, Fraxinus americana, Quercus nigra, Forestiera acuminata, Crataegus spathulata, Ilex opaca, Cephalanthus occidentalis, Cercis canadensis, Gleditsia aquatica, Rhus toxicodendron.

Table 54. Size classes (dbh) of plant species located in Community 24.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Ulmus crassifolia	88	15	21	2	2					
Quercus lyrata	1	1	2	7	8	3	3	2	2	
Fraxinus pensylvanica	105	6	5	8	1		1			
Ilex decidua	115									
Ulmus americana*	12	4	7	7	2	3				
Cornus Drummondii	116		1							
Crataegus spp.	80	2	1							
Carya aquatica	9	2	6	4	2	1				
Celtis laevigata	29	9	3	2						
Quercus Phellos	8		1		1	3	1			
Others**	44	4	3	4	1				1	
Total	607	43	50	34	17	10	5	2	3	

* May include Ulmus rubra.

** See Table 53 for a list of other species present.

Table 55. Frequency, density and dominance data for plant species located in Community 25.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Fraxinus pensylvanica	25.3	21.8	0.29	15.9	29.4	67.1
Quercus lyrata	17.5	15.1	0.19	10.2	17.9	43.2
Ulmus crassifolia	14.3	12.3	0.19	10.6	19.7	42.6
Celtis laevigata	14.3	12.3	0.17	9.2	15.2	36.7
Forestiera acuminata	9.7	8.4	0.38	20.8	0.9	30.1
Ilex decidua	13.0	11.2	0.29	15.9	1.0	28.1
Carya aquatica	10.4	8.9	0.14	7.4	8.4	24.7
Ulmus americana**	3.2	2.8	0.03	1.8	5.9	10.5
Diospyros virginiana	3.9	3.4	0.10	5.3	0.7	9.4
Carya illinoinensis	1.3	1.1	0.01	0.7	***	1.8
Others****		3.0	0.05	2.3	0.9	6.2
Total	----	100.3	1.84	100.1	100.0	300.4

* Sum of relative frequency, relative density and relative dominance.

** May include Ulmus rubra.

*** Value less than 0.1.

**** Other species present listed in order of decreasing importance values: Acer Negundo, Cornus Drummondii, Gleditsia triacanthos, Gleditsia aquatica, Morus rubra.

Table 56. Size classes (dbh) of plant species located in Community 25.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Fraxinus pensylvanica	12	10	7	12	3	1				
Quercus lyrata	9	1	9	6	3	1				
Ulmus crassifolia	10	5	3	4	8					
Celtis laevigata	7	4	8	4	3					
Forestiera acuminata	59									
Ilex decidua	45									
Carya aquatica	8	3	6	4						
Ulmus americana*	1	1	1		1		1			
Diospyros virginiana	13	2								
Carya illinoinensis	2									
Others**	4	1	1							
Total	170	27	35	30	18	2	1			

* May include Ulmus rubra.

** See Table 55 for a list of other species present.

STUDY AREA 6B

Introduction

Study Area 6B is situated in Anderson County in the big bend of the Trinity River immediately below the junction of the river with Highways 79 and 84. It is also within the Long Lake Oil Field. Land use information for Anderson County was presented in Study Area 6A and therefore will not be repeated in this section. Field analyses were accomplished during the early summer of 1974.

The topography of the immediate study sites was generally flat with occasional sloughs and depressions. Geologically the area is composed of Alluvium deposits of Recent origin within the Quaternary Period. The soils were either Trinity Clay or Kaufman Clay and have been described in Study Area 6A.

Methods and Procedures

There were 4 study communities (Communities 26, 27, 28 and 29) in Study Area 6B. The location of these communities and the position of study transects therein, is presented in Figure 14. A total of 718 plots were analyzed in Study Area 6B with 200 plots analyzed in Community 26, 206 in Community 27, 154 in Community 28 and 158 in Community 29.

Description of Study Sites

Community 26 was located southwest of Long Lake and west of McCracken Lake (Fig. 14). The topography was flat and the soil type was Kaufman Clay. Community 27 bordered the Trinity River south of the above mentioned lakes. Although the topography was generally flat, that near the river was gently rolling. The soil type was Trinity Clay. Communities 28 and 29 were situated to the east of McCracken Lake a short distance from the river (Fig. 14). It appeared that all of the sites have been selectively logged in the past and most were presently grazed by livestock.

Results

Community 26

Only part of Community 26 was presently grazed by livestock. The ungrazed forest had a more dense woody understory and herbaceous layer than did the grazed forest.

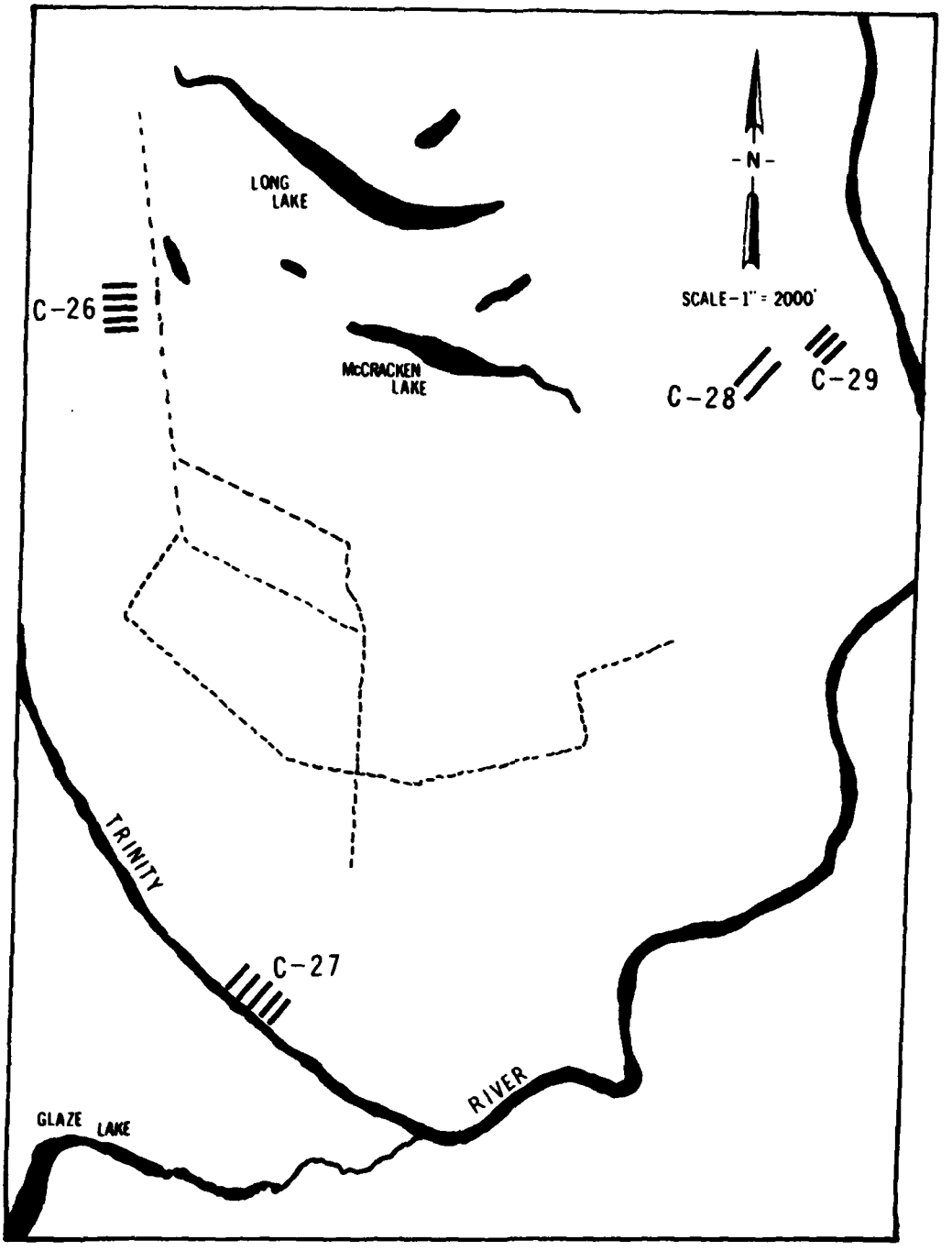


Fig. 14. Location of Communities 26, 27, 28 and 29 (C-26, C-27, C-28,and C-29) and position of study transects (solid lines).

Overall, Texas sugarberry (Celtis laevigata), cedar elm (Ulmus crassifolia), willow oak (Quercus Phellos), green ash (Fraxinus pensylvanica) and American elm (Ulmus americana) dominated the overstory whereas deciduous holly (Ilex decidua) and roughleaf dogwood (Cornus Drummondii) were understory dominants (Table 57). There was an average of about 7 plants per plot representing a total of 22 species. There were a few large trees present but most had dbh less than 40 cm (Table 58).

Community 27

Shrubby species were abundant in Community 27 with deciduous holly dominating the community and forestiera (Forestiera ligustrina), roughleaf dogwood and hawthorn (Crataegus spp.) also prevalent (Table 59). Principal tree species were Texas sugarberry, cedar elm, white ash (Fraxinus americana) and post oak (Quercus stellata) (there is the possibility that post oak may be bottomland post oak (Q. similis) as a result of the bottomland habitat). There were 23 species recorded in Community 27 averaging about 7 plants per plot. Most species had dbh less than 40 cm (Table 60).

Community 28

Community 28 was mostly comprised of small trees of green ash, Texas sugarberry and cedar elm (Tables 61 and 62). Although deciduous holly was somewhat prevalent, the understory was generally open. Fifteen species were recorded in Community 28 and they averaged about 6 plants per plot.

Community 29

Texas sugarberry was the dominant species in Community 29 (Table 63). Small thickets of deciduous holly and roughleaf dogwood were also common. Cedar elm was quite prevalent along with bur oak (Quercus macrocarpa), red mulberry (Morus rubra) and hawthorn. As a result of the deciduous holly and roughleaf dogwood thickets, shrub and tree density was slightly higher than in the other communities of this study area, averaging a little over 8 plants per plot. With one exception, tree dbh were all less than 40 cm (Table 64). There was a total of 14 species recorded in Community 29.

Table 57. Frequency, density and dominance data for plant species located in Community 26.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Celtis laevigata	59.0	17.7	1.08	15.1	23.5	56.3
Ulmus crassifolia	55.0	16.5	0.90	12.5	25.0	54.0
Cornus Drummondii	45.0	13.5	2.05	28.7	1.5	43.7
Ilex decidua	60.5	18.2	1.61	22.5	1.7	42.4
Quercus Phellos	17.5	5.3	0.33	4.6	17.4	27.3
Fraxinus pensylvanica	25.0	7.5	0.34	4.8	8.8	21.1
Ulmus americana**	23.5	7.1	0.27	3.7	6.3	17.1
Morus rubra	13.0	3.9	0.16	2.2	2.5	8.6
Carya illinoinensis	7.0	2.1	0.09	1.2	3.1	6.4
Carya aquatica	3.5	1.1	0.04	0.6	2.9	4.6
Others***		7.4	0.34	4.3	7.5	19.2
Total	----	100.3	7.21	100.2	100.2	300.7

* Sum of relative frequency, relative density and relative dominance.

** May include Ulmus rubra.

*** Other species present listed in order of decreasing importance values: Quercus lyrata, Cercis canadensis, Crataegus spp., Quercus stellata, Diospyros virginiana, Bumelia lanuginosa, Sapindus Saponaria, Acer Negundo, Gleditsia triacanthos, Sophora affinis, Fraxinus americana, Forestiera acuminata.

Table 58. Size classes (dbh) of plant species located in Community 26.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Celtis laevigata	102	102	10	2						
Ulmus crassifolia	97	52	26	3	1					
Cornus Drummondii	410									
Ilex decidua	321									
Quercus Phellos	40	8	6	5	4	2				
Fraxinus pensylvanica	30	27	11							
Ulmus americana*	35	7	10	1						
Morus rubra	18	11	2							
Carya illinoinensis	9	2	4	2						
Carya aquatica	1	1	4	2						
Others**	46	11		1		1	1			
Total	1109	221	73	16	5	3	1			

* May include Ulmus rubra.

** See Table 57 for a list of other species present.

Table 59. Frequency, density and dominance data for plant species located in Community 27.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Ilex decidua	56.8	18.9	2.62	36.2	3.1	58.2
Celtis laevigata	37.4	12.4	0.90	12.5	26.1	51.0
Ulmus crassifolia	25.2	8.4	0.55	7.6	21.3	37.3
Fraxinus americana	25.7	8.5	0.43	6.0	10.5	25.0
Quercus stellata	18.4	6.1	0.22	3.0	15.5	24.6
Forestiera ligustrina	23.8	7.9	0.68	9.4	0.4	17.7
Fraxinus pensylvanica	11.2	3.7	0.15	2.1	6.0	11.8
Cercis canadensis	16.0	5.3	0.25	3.5	1.1	9.9
Cornus Drummondii	8.7	2.9	0.39	5.4	0.3	8.6
Crataegus spp.	12.6	4.2	0.20	2.8	1.6	8.6
Others**	65.2	21.7	0.82	11.3	14.1	47.1
Total	----	100.0	7.21	99.8	100.0	299.8

* Sum of relative frequency, relative density and relative dominance.

** Other species present listed in order of decreasing importance values: Sapindus Saponaria, Sophora affinis, Bumelia lanuginosa, Quercus macrocarpa, Quercus Shumardii, Prunus mexicana, Viburnum rufidulum, Quercus Phellos, Forestiera acuminata, Morus rubra, Gleditsia triacanthos, Quercus lyrata, Viburnum dentatum.

Table 60. Size classes (dbh) of plant species located in Community 27.

Species	Size Classes (cm)								
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Ilex decidua	539									
Celtis laevigata	74	86	22	2						
Ulmus crassifolia	63	22	22	5	1					
Fraxinus americana	51	25	12	1						
Quercus stellata	11	12	17	3	2					
Forestiera ligustrina	140									
Fraxinus pensylvanica	19	5	5	2						
Cercis canadensis	50	2								
Cornus Drummondii	80									
Crataegus spp.	35	6								
Others*	139	16	11	2			1			
Total	1201	174	89	15	3		1			

* See Table 59 for a list of other species presnet.

Table 61. Frequency, density and dominance data for plant species located in Community 28.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Fraxinus pensylvanica	61.7	21.7	1.66	29.0	44.9	95.6
Celtis laevigata	82.5	29.0	1.94	33.7	27.0	89.7
Ulmus crassifolia	35.7	12.6	0.67	11.7	2.2	26.5
Ilex decidua	27.3	9.6	0.53	9.2	0.6	19.4
Quercus Phellos	11.7	4.1	0.12	2.0	9.4	15.5
Quercus lyrata	13.6	4.8	0.16	2.8	2.8	10.4
Morus rubra	12.3	4.3	0.14	2.5	2.5	9.3
Ulmus americana**	12.3	4.3	0.17	2.9	2.0	9.2
Quercus macrocarpa	7.1	2.5	0.09	1.6	4.0	8.1
Carya illinoinensis	4.5	1.6	0.05	0.8	2.2	4.6
Others***		5.5	0.22	3.8	2.2	11.5
Total	----	100.0	5.75	100.0	99.8	299.8

* Sum of relative frequency, relative density and relative dominance.

** May include Ulmus rubra.

*** Other species present listed in order of decreasing importance values: Carya aquatica, Crataegus spp., Forestiera acuminata, Cornus Drummondii, Sophora affinis.

Table 62. Size classes (dbh) of plant species located in Community 28.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Fraxinus pensylvanica	101	133	18	4						
Celtis laevigata	199	89	11	1						
Ulmus crassifolia	101		1	1						
Ilex decidua	81									
Quercus Phellos	6	1	5	5	1					
Quercus lyrata	12	12	1							
Morus rubra	13	8	1							
Ulmus americana*	17	9								
Quercus macrocarpa	5	4	4	1						
Carya illinoinensis	4	1	1	1						
Others**	25	9								
Total	564	266	42	13	1					

* May include Ulmus rubra.

** See Table 61 for a list of other species present.

Table 63. Frequency, density and dominance data for plant species located in Community 29.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Celtis laevigata	72.8	21.5	2.14	26.0	45.3	92.8
Ilex decidua	51.9	15.3	1.85	22.6	3.5	41.4
Cornus Drummondii	46.2	13.6	1.95	23.7	2.3	39.6
Ulmus crassifolia	41.1	12.1	0.62	7.6	15.0	34.7
Quercus macrocarpa	22.2	6.5	0.25	3.1	11.8	21.4
Morus rubra	20.9	6.2	0.23	2.8	8.4	17.4
Crataegus spp.	27.8	8.2	0.37	4.5	2.3	15.0
Fraxinus pensylvanica	15.2	4.5	0.23	2.9	2.3	9.7
Quercus Phellos	15.2	4.5	0.23	2.9	2.1	9.5
Ulmus americana**	12.0	3.6	0.20	2.4	1.9	7.9
Others***		4.0	0.13	1.7	5.0	10.7
Total	----	100.0	8.20	100.2	99.9	300.1

* Sum of relative frequency, relative density and relative dominance.

** May include Ulmus rubra.

*** Other species present listed in order of decreasing importance values: Carya illinoinensis, Carya aquatica, Bumelia lanuginosa, Sophora affinis.

Table 64. Size classes (dbh) of plant species located in Community 29.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Celtis laevigata	160	154	22	2						
Ilex decidua	293									
Cornus Drummondii	308									
Ulmus crassifolia	76	8	4	9		1				
Quercus macrocarpa	21	6	8	5						
Morus rubra	9	22	2	3						
Crataegus spp.	50	8								
Fraxinus pensylvanica	32	3	2							
Quercus Phellos	33	1	3							
Ulmus americana*	28	2		1						
Others**	7	9	5	1						
Total	1017	213	46	21		1				

* May include Ulmus rubra.

** See Table 63 for a list of other species present.

STUDY AREA 7

Introduction

Study Area 7 was located in southeastern Leon County just west and north of the junction of Lower Keechi Creek and the Trinity River (Fig. 15). Study sites were situated within the floodplain of the Trinity River, on the adjacent slope to upland, and on the more level upland. Collection of data was accomplished during the spring of 1973.

Topographically, the study sites varied from nearly flat, poorly drained floodplain to the more elevated slope and ridge areas. Geologically, the area is composed of Alluvium deposits of Recent origin within the Quaternary Period. Included perhaps are some Deweyville deposits as well as a few small inliers of Tertiary formations. Fluviatile terrace deposits of Pleistocene origin within the Quaternary Period were also present.

In the vicinity of the junction of Lower Keechi Creek and the Trinity River, the major soil types are the Tuscumbia, Travis and Bienville loamy fine sand. Probably the most extensive soil is the Tuscumbia, which is similar to Kaufman Clay. This soil occupies nearly level, slightly concave bottomland flood plains. This somewhat slowly drained soil is poorly suited for dwellings, sewage systems, local roads, most recreational uses, and cropland. It is well suited for woodland and wetland wildlife and for pond reservoir areas and is fairly well suited for grassland and woodland (U. S. Department of Agriculture, unpublished data).

The Travis soil occupies the slope area between the low, poorly drained Tuscumbia soil adjoining the creek and the more elevated and level Bienville loamy fine sand soil. The degree of slope (5-12%) hinders the utility of this soil for some uses.

The Bienville loamy fine sand soil occupies the most elevated portions of the study area, occurring on the broad, nearly level to gently sloping crests west of Lower Keechi Creek. This soil is somewhat excessively drained as a result of a low moisture holding capacity and is seasonally droughty during the summer and fall onths. It is well suited for dwellings, septic tank filter beds, local roads and streets, and light industry. It has fair suitability for camp and picnic areas, playgrounds, most wildlife and woodland. Although the Bienville loamy fine

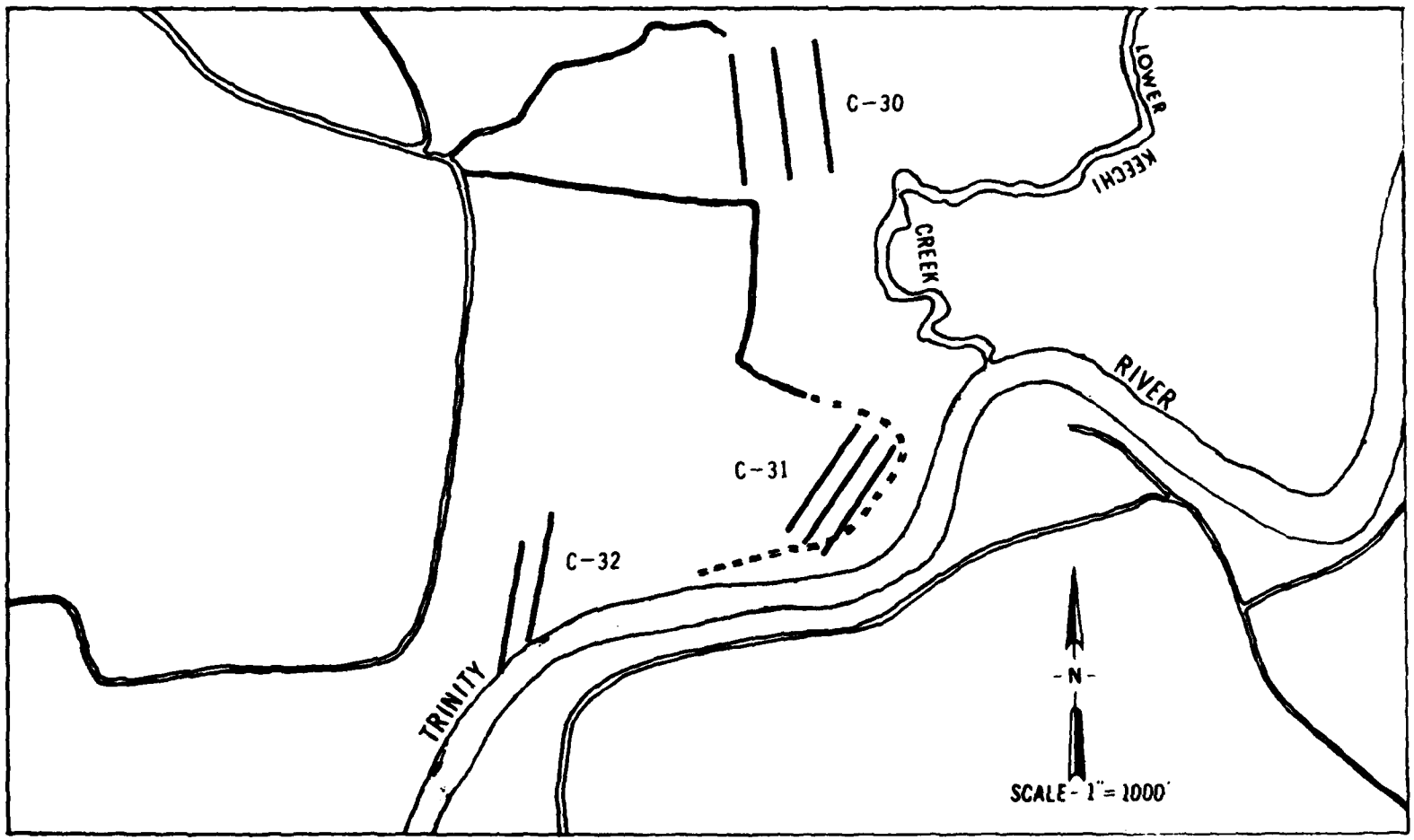


Fig. 15. Location of Communities 30, 31 and 32 (C-30, C-31 and C-32) and position of study transects (solid lines).

sand soil was classified as poorly suited for cropland and grassland, some parts have been cleared for pasture in the vicinity of the study area.

The three study sites were forested, but some nearby land has been cleared for pasture. Grazing by cattle of the entire area was evident.

Land Use

The number of inhabitants of sparsely populated Leon County dropped from 9,951 in 1960 to 8,738 in 1970 (Texas Almanac, 1971). Buffalo, the largest town in the county, had a population of 1,242 in 1970 while Centerville, the county seat, had 831. In 1970 less than 3400 people lived in towns in Leon County. The economy is based on agriculture. Of the $16,724,000 total income, $10,000,000 was farm income, while minerals, chiefly oil and gas, contributed $4,645,000. Eighty percent of the agricultural income is derived from livestock. Cotton, grain, melons and peas are the main crops.

Of the more than 693,000 acres of land in Leon County, less than 12,000 acres were classified as non-commerical in 1970 (Table 65) (Leon County Conservation Needs Committee, 1970). Between 1958 and 1967, non-commercial area increased from 9,865 acres to 11,556. Most of the increase was in the urban and built-up category, representing fringe growth of the small towns and an influx of people, mainly from Houston, into recreation areas.

Of the county's total area, over 48% was in pasture and range in 1970. Between 1958 and 1967, pastureland acreage increased from 99,177 acres to 320,100 acres while range jumped from 4,115 to 17,075 acres. Most of the gain was at the expense of cropland, which fell from 150,593 to 61,292 acres, and of forest, which dropped from 434,363 acres in 1958 to 292,800 acres in 1967. The classification "other land" dropped almost 50%, from 5,208 acres to 2,189 acres. With the county's loss of population and the trend away from intensive row cropping and toward cattle raising, the number of farmsteads has apparently declined.

Leon County can be expected to see future development of certain areas for outdoor recreation. An appraisal of potential for outdoor recreational development in Leon County (Anonymous, 1967d) predicts a high potential for picnicking and field sports, transient camping, fishing, deer hunting, riding stables, and shooting preserves.

Table 65. Leon County land area (in acres)
(from Leon County Conservation Needs Committee, 1970)

Land Use	1958	1967
Total land area	703,320	705,012
Less: Federal non-cropland	0	0
Less: Urban and built-up	8,824	10,156
Less: Small water areas	1,040	1,400
Total non-commercial area	9,864	11,556
Total commercial farm and forest area	693,456	693,456
Cropland	150,593	61,292
Pasture	99,177	320,100
Range	4,115	17,075
Forest	434,363	292,800
Other land	5,208	2,189

Vacation cabins and homesites, as well as water sports areas, received a high medium rating. Perhaps due to the lack of proximity to large reservoirs for fishing and boating, weekend home building has not yet experienced the boom as witnessed in Polk, San Jacinto and Liberty counties along the lower Trinity River.

Methods and Procedures

Study Area 7 was comprised of three study sites (Fig. 15). The more undisturbed plant communities were selected to represent the woody vegetation of the area. Transects were positioned as shown in Figure 15. A total of 800 plots (five meters square) were analyzed, 300 each at Communities 30 and 31 and 200 at Community 32.

Description of Study Sites

Community 30 was located on a slope and level ridge west of Lower Keechi Creek and north of its junction with the Trinity River (Fig. 15). Transects were located along contours on the ridge and one-third and two-thirds of the way down the slope. The area was well drained and supported a greater habitat diversity than the other two study sites. Community 31 was in a cedar elm flat west of Lower Keechi Creek and north of the Trinity River (Fig. 15). The site was poorly drained and showed evidence of flooding. Several permanently ponded or excessively moist areas were present. Community 31 was composed of a more rolling topography traversed by several drainings and an intermittant creek. It was located adjacent to the river west of Lower Keechi Creek (Fig. 15).

Results

Community 30

The forest at Community 30 had a more varied habitat than the other two sites at Study Area 7 and, with 34 woody species recorded, the greatest diversity of species. American beautyberry (Callicarpa americana) dominated the understory shrubs on both slope and ridge areas. Along the ridge, post oak (Quercus stellata) and black hickory (Carya texana) were dominant tree species while farkleberry (Vaccinium arboreum), Indian cherry (Rhamnus caroliniana), sweetgum (Liquidambar Styraciflua) and flowering dogwood (Cornus florida) were less abundant woody species. Post oak was still dominant on the upper portion of the slope. Abundant associated species were black walnut (Juglans nigra) and sweetgum. Black hickory

was less frequent. Two-thirds of the way down the slope, eastern redbud (Cercis canadensis), winged elm (Ulmus alata), black walnut, sweetgum and red oak (Quercus falcata) occurred with nearly equal abundance.

Table 66 is a summary of the woody vegetational data gathered at Community 30. Overall, American beautyberry was the dominant understory species and post oak the dominant overstory species (Table 66). Black hickory, sweetgum and black walnut were also prevalent. Most individuals were less than 40 cm in diameter at breast height (Table 67). Only two recorded trees of post oak and one of sweetgum exceeded 50 cm in diameter.

Community 31

Community 31 was strongly dominated by cedar elm (Ulmus crassifolia) in the overstory and by deciduous holly (Ilex decidua) in the understory (Table 68). Much less abundant were willow oak (Quercus Phellos), honey locust (Gleditsia triacanthos), hawthorn (Crataegus spp.) and Texas sugarberry (Celtis laevigata). Permanently ponded or excessively wet areas were dominated by swamp privet (Forestiera acuminata), overcup oak (Quercus lyrata), green ash (Fraxinus pensylvanica), and water locust (Gleditsia aquatica). Except for thickets of swamp privet in portions of the wet areas, the forest was open. Sedges (Carex spp.) comprised much of the herbaceous layer. Most trees at Community 31 were less than 40 cm in dbh (Table 69). There were, however, a few widely scattered individuals of cedar elm, willow oak and overcup oak with larger diameters. Seventeen woody species were recorded at Community 31.

Community 32

Fourteen woody species were recorded at Community 32, with Texas sugarberry, cedar elm and pecan (Carya illinoinensis) being the principal species (Table 70). Deciduous holly and swamp privet were the dominant understory species. Swamp privet, green ash and water locust dominated the occasional wet areas. The forest was generally open except along the river where greenbriar (Smilax spp.) and blackberry (Rubus spp.) formed dense clumps. Most trees had dbh less than 50 cm (Table 71). Only 1.87 trees per plot were recorded.

Table 66. Frequency, density and dominance data for plant species located in Community 30.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Callicarpa americana	84.0	31.4	2.41	48.2	1.9	81.5
Quercus stellata	14.7	5.5	0.18	3.5	29.4	38.4
Carya texana	13.7	5.1	0.15	3.0	12.7	20.8
Liquidambar Styraciflua	9.3	3.5	0.12	2.5	12.5	18.5
Juglans nigra	15.0	5.6	0.17	3.4	6.9	15.9
Vaccinium arboreum	15.7	5.9	0.29	5.9	1.2	13.0
Cercis canadensis	14.0	5.2	0.24	4.9	1.5	11.6
Forestiera ligustrina	17.3	6.5	0.22	4.5	0.6	11.6
Ulmus alata	10.7	4.0	0.20	3.9	2.0	9.9
Quercus falcata	7.0	2.6	0.11	2.2	4.6	9.4
Others**		24.5	0.90	18.1	26.8	69.4
Total		99.8	4.99	100.1	100.1	300.0

* Sum of relative frequency, relative density, and relative dominance.
** Other species present listed in order of decreasing importance values: Cornus florida, Ulmus crassifolia, Fraxinus americana, Rhamnus caroliniana, Quercus marilandica, Sassafras albidum, Celtis laevigata, Ulmus americana (may include Ulmus rubra), Bumelia lanuginosa, Tilia americana (includes T. caroliniana and T. floridana), Carya cordiformis, Ilex decidua, Nyssa sylvatica, Fraxinus pensylvanica, Ilex vomitoria, Morus rubra, Quercus nigra, Platanus occidentalis, Myrica cerifera, Crataegus spathulata, Crataegus spp., Zanthoxylum Clava-Herculis, Crataegus Marshallii, Diospyros virginiana.

Table 67. Size classes (dbh) of plant species located at Community 30.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Callicarpa americana	722									
Quercus stellata	10	13	8	19	1	2				
Carya texana	16	9	16	4						
Liquidambar Styraciflua	21	4	5	5	1	1				
Juglans nigra	36	9	4	2						
Vaccinium arboreum	87		1							
Cercis canadensis	69	4								
Forestiera ligustrina	65	2								
Ulmus alata	54	4	1							
Quercus falcata	27	2	1	1	2					
Others*	198	50	14	8	1					
Total	1305	97	50	39	5	3				

* See Table 66 for a list of other species present.

Table 68. Frequency, density and dominance data for plant species located in Community 31.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Ulmus crassifolia	23.0	29.2	0.30	22.1	60.5	111.8
Ilex decidua	21.3	27.1	0.50	37.0	3.2	67.3
Quercus Phellos	2.3	3.0	0.02	1.7	13.3	18.0
Gleditsia triacanthos	5.7	7.2	0.10	7.6	2.3	17.1
Crataegus spp.	7.3	9.3	0.08	6.1	1.5	16.9
Forestiera acuminata	2.3	3.0	0.18	13.0	0.8	16.8
Quercus lyrata	2.7	3.4	0.03	2.0	6.0	11.4
Fraxinus pensylvanica	3.0	3.8	0.03	2.5	4.1	10.4
Celtis laevigata	2.3	3.0	0.02	1.7	3.1	7.8
Gleditsia aquatica	2.3	3.0	0.02	1.7	2.5	7.2
Others**		7.9	0.07	4.6	2.7	15.2
Total	----	99.9	1.35	100.0	100.0	299.9

* Sum of relative frequency, relative density and relative dominance.

** Other species present listed in order of decreasing importance values: Bumelia lanuginosa, Diospyros virginiana, Carya illinoinensis, Sophora affinis, Planera aquatica, Crataegus spathulata. Sabal minor, not included in column totals, had a density of 0.01 individuals per plot.

Table 69. Size classes (dbh) of plant species located at Community 31.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Ulmus crassifolia	11	10	37	29	3					
Ilex decidua	151									
Quercus Phellos		1	1	1	1	2	1			
Gleditsia triacanthos	26	5								
Crataegus spp.	20	5								
Forestiera acuminata	53									
Quercus lyrata	3		1	3	1					
Fraxinus pensylvanica	5	2	1	2						
Celtis laevigata	4		1	2						
Gleditsia aquatica	2	2	2	1						
Others*	16	1	1	1						
Total	291	26	44	39	5	2	1			

* See Table 68 for a list of other species present.

Table 70. Frequency, density and dominance data for plant species located at Community 32.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance Value*
Celtis laevigata	30.5	31.0	0.61	33.3	17.7	82.0
Ulmus crassifolia	18.5	18.8	0.29	15.8	33.2	67.8
Carya illinoinensis	5.5	5.6	0.07	3.8	25.3	34.7
Forestiera acuminata	7.5	7.6	0.39	21.3	3.1	32.0
Ilex decidua	15.5	15.7	0.23	12.3	2.1	30.1
Fraxinus pensylvanica	4.0	4.1	0.04	2.2	11.0	17.3
Gleditsia aquatica	7.0	7.1	0.08	4.1	3.5	14.7
Crataegus spp.	4.0	4.1	0.05	2.5	0.6	7.2
Gleditsia triacanthos	2.5	2.5	0.04	1.9	0.6	5.0
Bumelia lanuginosa	1.0	1.0	0.02	1.1	2.3	4.4
Others**		2.5	0.05	1.7	0.6	4.8
Total	----	100.0	1.87	100.0	100.0	300.0

* Sum of relative frequency, relative density, and relative dominance.

** Other species present listed in order of decreasing importance values: Ulmus americana (may include Ulmus rubra), Sophora affinis, Acer Negundo, Vaccinium arboreum.

Table 71. Size classes (dbh) of plant species located at Community 32.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Celtis laevigata	97	17	3	4	1					
Ulmus crassifolia	26	8	9	13	2					
Carya illinoinensis	7	3		1			1		2	
Forestiera acuminata	74	4								
Ilex decidua	45									
Fraxinus pensylvanica	2	1	1	1	2	1				
Gleditsia aquatica	9	2	4							
Crataegus spp.	8	1								
Gleditsia triacanthos	5	2								
Bumelia lanuginosa	3				1					
Others*	8	2	4							
Total	284	40	21	19	6	1	1		2	

* See Table 70 for a list of other species present.

STUDY AREA 8

Introduction

The objective of this phase of the study was to analyze the woody vegetation of 3 swamps and associated terrestrial forests located in the vicinity of the Trinity River. Field work was accomplished during the fall of 1972. The study area was situated within San Jacinto County in southeast Texas. More specifically, it is located in the extreme eastern part of San Jacinto County between Shepherd, Texas, and the Trinity River (Fig. 16).

The topography of the area is flat to very gently rolling and occasionally characterized by the presence of depressions, sloughs and creeks. Geologically the area is composed of Alluvium deposits of Recent origin within the Quaternary Period. There are many small inliers of Tertiary formations and along minor streams outcroppings of Deweyville and Pleistocene formations occur. The Deweyville Formation lies along the western edge of the study area. There are three soils present, Tuckerman loam, Bernaldo fine sandy loam and Kaufman clay (U. S. Department of Agriculture, unpublished data). The Tuckerman soils occupy nearly level concave areas and are generally poorly drained and ponded. They are poorly suited for dwellings, general recreation use, cropland or grassland but are suited for pond reservoir areas and woodland and wetland wildlife. The Bernaldo fine sandy loam soils occupy well-drained, slightly sloping sites adjacent to Tuckerman soils in our study area. They are suited for dwellings, woodland, grassland, cropland and wildlife. The Kaufman clay soils occupy the somewhat poorly drained bottomland floodplain areas. They are slightly better drained than the Tuckerman soils but are suited primarily for pond reservoir areas and woodland and wetland wildlife. They have some potential for grassland.

The vegetation of the study area was mostly woodland occupying both aquatic and terrestrial sites. Cleared sites within the study area were generally associated with roads and pipelines but more upland surrounding areas contain larger acreages of pasture and cropland. Grazing by cattle was evident and it appeared that all of the study area had been logged. Some swamp areas have not been logged since the early 1920's but other areas have been selectively logged within recent years.

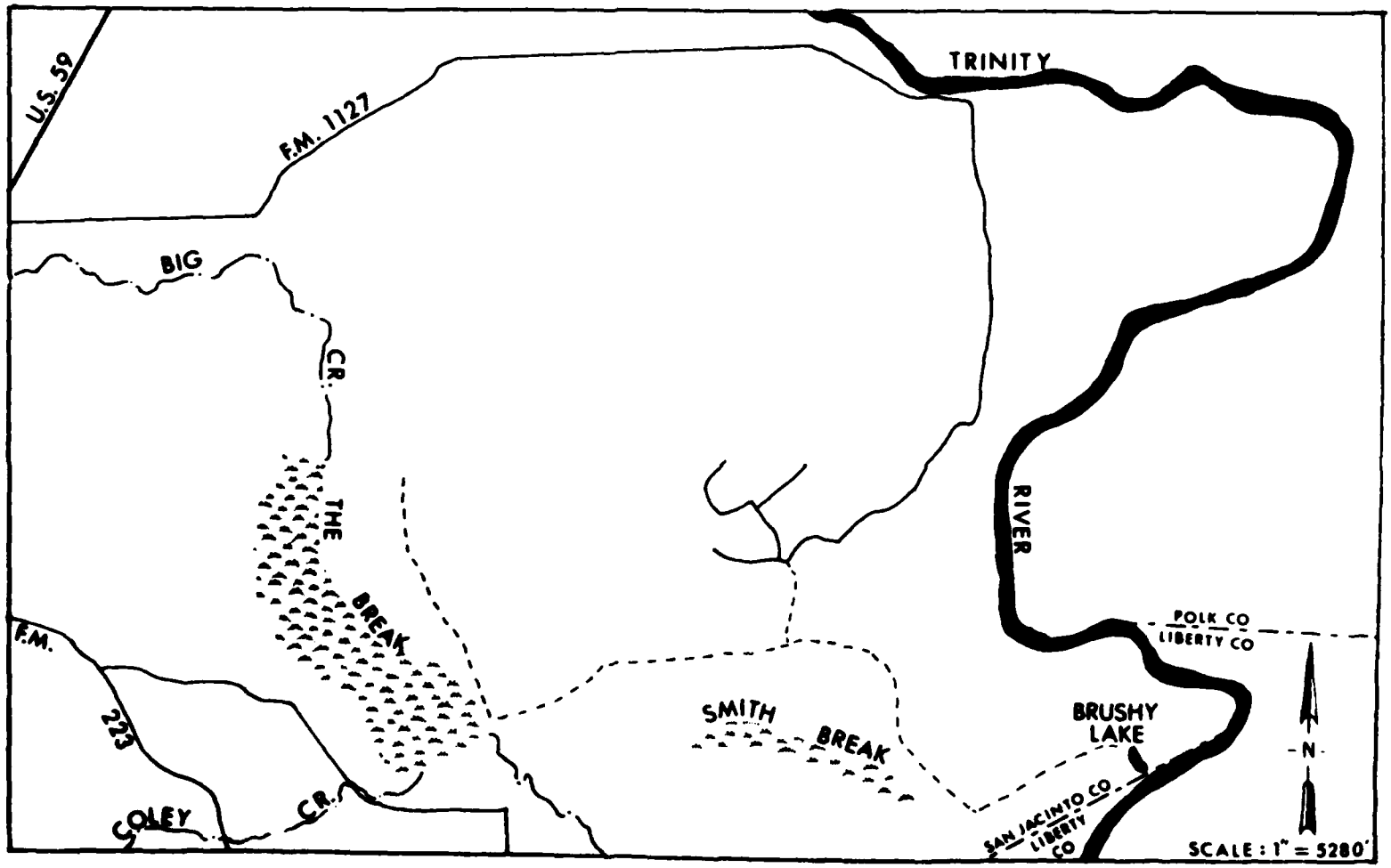


Fig. 16. Showing the study area in relation to the Trinity River.

Land Use

San Jacinto County is mainly a rural area, with less than 1900 people living in the two largest towns in the county. Most of the land is forested (Table 72). Out of 399,360 acres, some 258,100 acres were in commercial forest in 1967, with an additional 58,592 acres of National Forest within the county. Between 1958 and 1967, cropland acreage declined by over 75%, while forest area declined about 10%. Pastureland acreage increased six times over, however, from 10,625 acres to 67,117 acres (Conservation Needs Committee, 1967).

Within easy driving distance of Houston and the coastal population concentrations, bordering Lake Livingston, and containing part of Sam Houston National Forest, San Jacinto County can expect to be increasingly affected by demands for outdoor recreation. An appraisal of potential for outdoor recreational developments in San Jacinto County (Miller, et al., 1967) indicated that water sports and fishing, vacation cabins, cottages and homesites, small and big game hunting, and campgrounds for transient camping and vacation sites have especially high potential for development.

The area of land used for pasture will probably slowly increase at the expense of cropland and forest. The major change will probably be in land developed for weekend and retirement homes. Polk and Liberty counties are already experiencing such a boom.

Within the study area, only the Bernaldo fine sandy loam soil, making up about a fourth of the total area, favors diversion of the land from forest to grassland, cropland or housing developments. It is probably inevitable that suitable land of this type near the river will eventually be developed for weekend and retirement homes as has already been done in Polk County on the opposite bank. Large scale development might include almost all of this well-drained soil. The Kaufman clay and Tuckerman loam soils, however, do not lend themselves to uses more intense than timber, grazing and wildlife. The current practice of grazing cattle beneath the forest during drier periods will likely remain the chief use of most of the area in the near future.

Methods and Procedures

Eight study communities composed the study area (Figs. 17 and 18). The more unique and undisturbed plant

Table 72. San Jacinto County land area (in acres)
(from Conservation Needs Committee, 1967)

Land Use	1958	1967
Total land area	396,160	399,360
Less: Federal non-cropland (Sam Houston National Forest)	58,592	58,592
Less: Urban and built-up	3,284	3,390
Less: Small water areas	1,200	1,380
Total non-commercial area	63,076	63,362
Total commercial farm and forest area	333,084	335,998
Cropland	36,281	8,853
Pasture	10,625	67,117
Forest	284,463	258,100
Other land	1,715	1,928

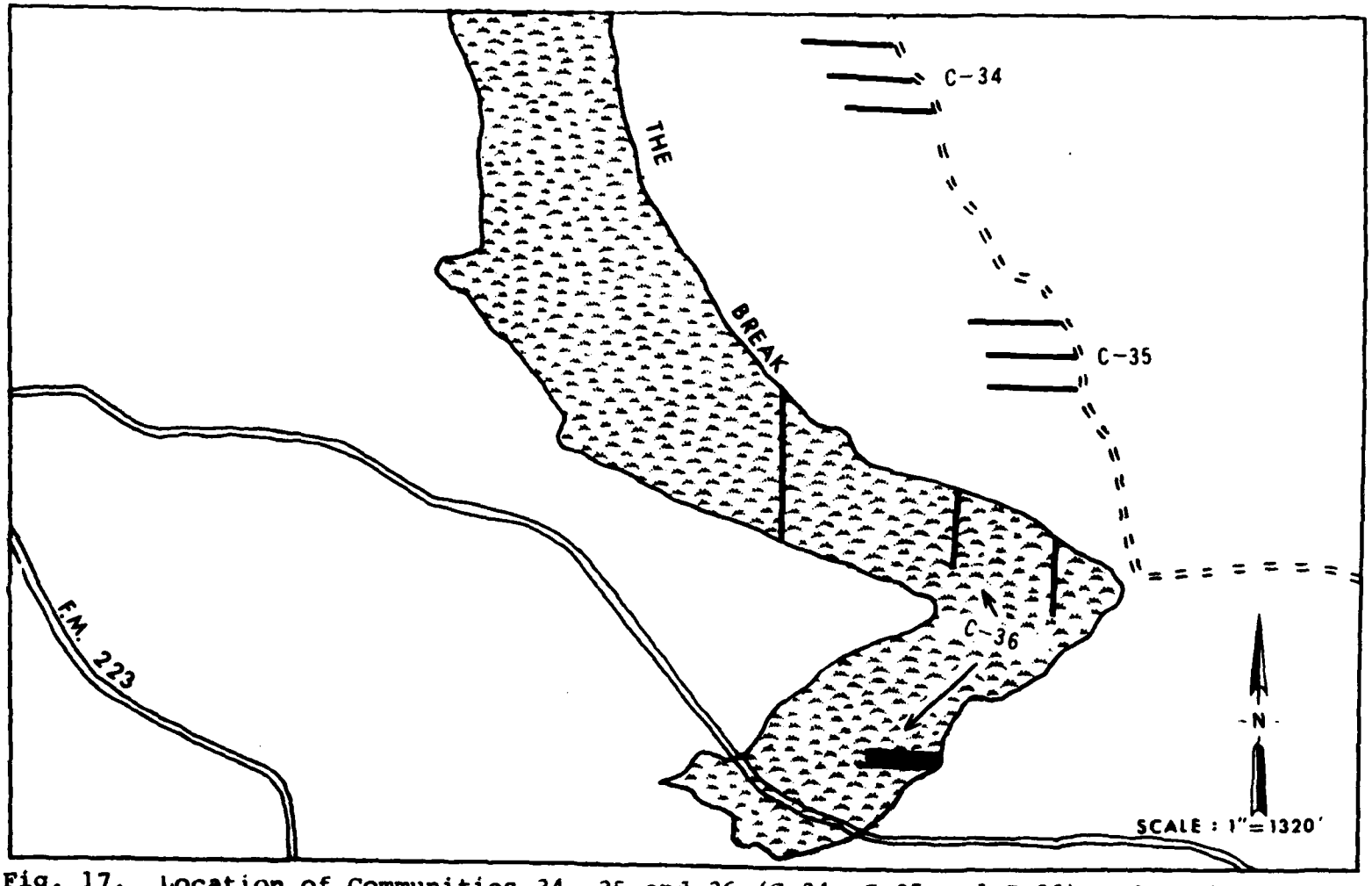


Fig. 17. Location of Communities 34, 35 and 36 (C-34, C-35 and C-36) and position of study transects (solid lines).

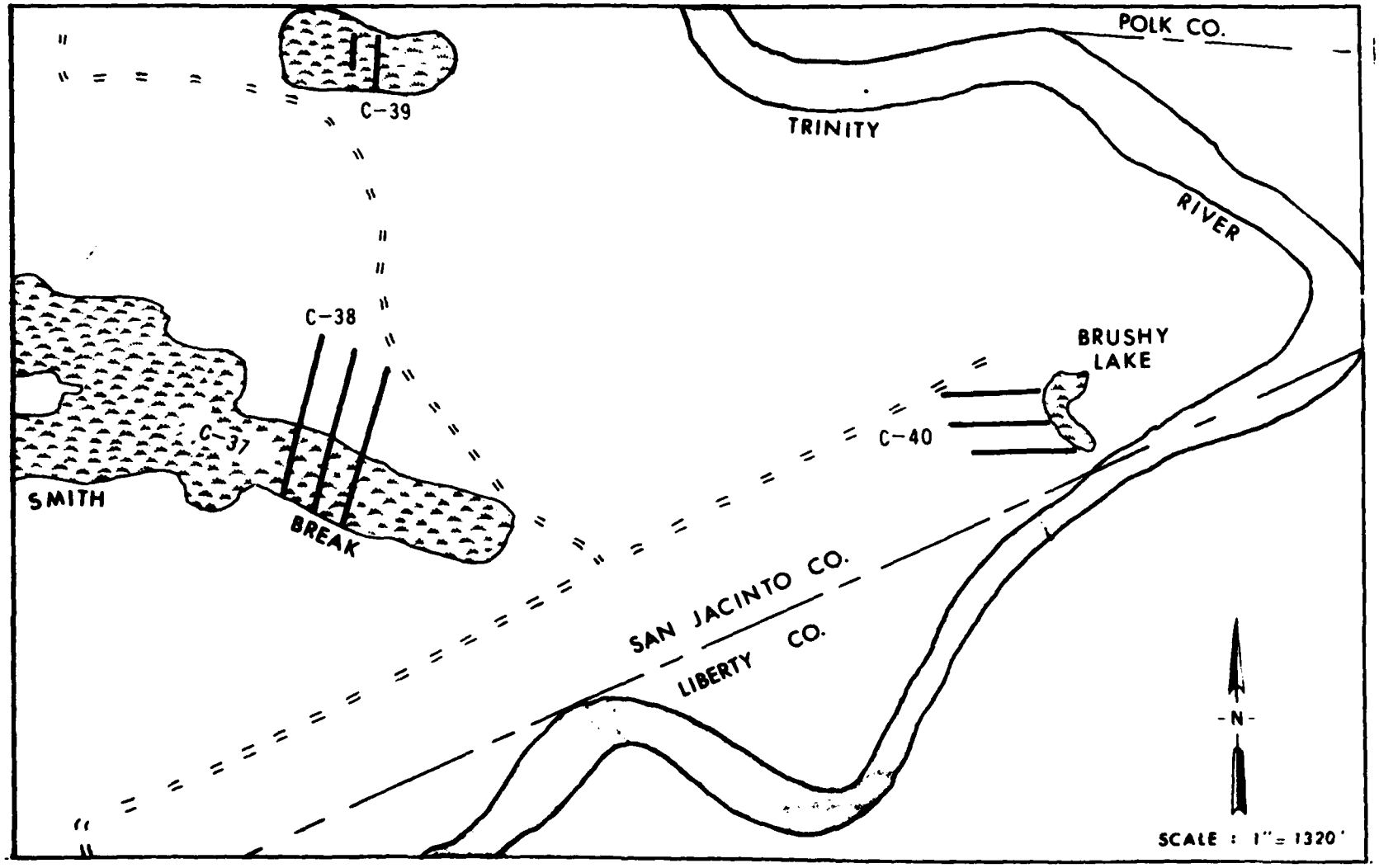


Fig. 18. Location of Communities 37, 38, 39 and 40 (C-37, C-38, C-39 and C-40) and position of study transects (solid lines).

communities were selected for analysis. Transects were positioned within each community as indicated in Figures 17 and 18. Plots in swamp areas were established with the use of twine strands transecting the swamp and marked at five meter intervals. A total of 2274 plots (five meters square) were analyzed. Three hundred plots were analyzed in each community with the exception of Communities 33 (104 plots), 36 (550 plots), 37 (320 plots) and 39 (100 plots).

Description of Study Sites

Community 33 was a black willow (Salix nigra) community located on the bank of the Trinity River in Polk County just south of the Lake Livingston Dam. It was not positioned in Figures 17 or 18 but is easily located as a result of its being the first forest below the dam. Communities 34 and 35 were terrestrial although portions of these communities may be temporarily inundated. They were located east of The Break (Fig. 17). Communities 36, 37 and 39 were swamps with Communities 36 and 37 referred to locally as The Break and Smith Break respectively (Figs. 17 and 18). Water prevails year-round in these swamps and they are located on Tuckerman loam soils. Water depth was generally less than 4 feet. Communities 38 and 40 were terrestrial communities associated with Smith Break and Brushy Lake respectively (Fig. 18). Community 34 was located on Kaufman clay and Bernaldo fine sandy loam soils. Community 35 probably transected all 3 soil types mentioned. Community 38 was situated on Kaufman clay soil and Community 40 on Tuckerman soil.

Results

Community 33

Sand bars along the Trinity River are often dominated by black willow. Therefore, a black willow community was included. The community analyzed was comprised of young willow trees associated mainly with young cottonwoods (Populus deltoides) (Table 73). All of the trees recorded had dbh less than 20 cm (Table 74). Only five shrub and tree species were recorded in Community 33 but representatives were densely associated, having an average of over 13 plants per plot.

Community 34

A forested area east of The Break with a rather uniform population of palmetto (Sabal minor) was analyzed

Table 73. Frequency, density and dominance data for plant species located in Community 33.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Salix nigra	99.0	78.0	13.18	97.4	98.1	273.5
Populus deltoides	23.1	18.2	0.31	2.3	1.8	22.3
Cephalanthus occidentalis	2.9	2.3	0.03	0.2	**	2.5
Platanus occidentalis	1.0	0.8	0.01	0.1	**	0.9
Forestiera acuminata	1.0	0.8	0.01	0.1	**	0.9
Total	----	100.1	13.54	100.1	99.9	300.1

* Sum of relative frequency, relative density and relative dominance.

** Less than 0.1.

Table 74. Size classes (dbh) of plant species located in Community 33.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Salix nigra	1242	129								
Populus deltoides	31	1								
Cephalanthus occidentalis	3									
Platanus occidentalis	1									
Forestiera acuminata	1									
Total	1278	130								

(Fig. 17). The palmettos had a frequency of 81.7% and a density of 4.76 plants per plot. This species, as a result, dominated the shrub layer of vegetation in this community. Dominant upper-layer species were water oak (Quercus nigra), sweetgum (Liquidambar Styraciflua) and southern red oak (Quercus falcata) (Table 75). These species were generally represented in the higher size classes (Table 76). Texas sugarberry (Celtis laevigata) and pecan (Carya illinoinensis) were also prevalent. Mid-layer subdominants included deciduous holly (Ilex decidua) and snowdrop-tree (Halesia diptera). Thirty-eight woody species were recorded in plots in this area. It should be noted that a honey locust (Gleditsia triacanthos) tree measuring 78 inches in circumference and 88 feet in height and having a crown spread of 57 feet is a possible state champion. Its index is 180 as compared to the present state champion's index of 147-1/2.

Community 35

Community 35 was a fairly open community dominated by hawthorn (Crataegus spp.) and cedar elm (Ulmus crassifolia) (Table 77). Cedar elm trees were less than 40 cm in dbh and hawthorn trees were, with two exceptions, entirely within the 1-10 cm size class (Table 78). Willow oak (Quercus Phellos), Texas sugarberry, black oak (Quercus velutina) and overcup oak (Quercus lyrata) trees were prevalent and representatives of these species were the only ones with diameters greater than 40 cm. There were 27 species of trees and shrubs recorded at this site with an average of 4.0 plants per plot.

Community 36

The Break is a swamp maintained by two creeks flowing incessently through its length. Big Creek, entering from the north, and Coley Creek, entering from the southwest, unite within The Break (Fig. 16). Based on importance value, tupelo (Nyssa aquatica) was the overwhelmingly dominant tree species in the swamp (Table 79). Bald cypress (Taxodium distichum) was somewhat prevalent. Both of these species showed good size-class distribution (Table 80). Subdominants in The Break were Carolina ash (Fraxinus caroliniana) and red maple (Acer rubrum). Sweet-spire (Itea virginica) was the most abundant shrub. These latter three species contained representatives mostly in the size class 1-10 cm (Table 80).

Community 37

The water in Smith Break was more stagnant than that in The Break. Smith Break was not transected by a creek

Table 75. Frequency, density and dominance data for plant species located in Community 34.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Quercus nigra	12.0	6.1	0.13	5.3	21.6	33.0
Liquidambar Styraciflua	13.3	6.8	0.18	7.2	16.4	30.4
Quercus falcata	11.3	5.8	0.17	5.5	11.3	22.6
Ilex decidua	17.3	8.8	0.22	8.9	1.0	18.7
Celtis laevigata	9.7	4.9	0.17	5.5	7.9	18.3
Carya illinoinensis	13.7	7.0	0.15	6.1	4.7	17.8
Halesia diptera	14.3	7.3	0.20	8.0	0.6	15.9
Gleditsia triacanthos	12.7	6.5	0.15	6.0	2.9	15.4
Ulmus alata	11.7	5.9	0.15	6.1	2.7	14.7
Ulmus americana**	7.0	3.6	0.07	3.0	7.4	14.0
Others***		37.3	0.87	38.3	23.7	99.5
Total	----	100.2	2.46	99.9	100.2	300.3

* Sum of relative frequency, relative density and relative dominance

** May include U. rubra.

*** Other species present listed in decreasing order of importance values: Quercus Prinus, Callicarpa americana, Quercus velutina, Ilex vomitoria, Carpinus caroliniana, Ilex opaca, Viburnum dentatum, Fraxinus pensylvanica, Sambucus canadensis, Diospyros

Table 75. (cont.)
virginiana, Crataegus spp., Cornus racemosa, Morus rubra, Nyssa sylvatica, Acer rubrum, Crataegus spathulata, Crataegus Marshallii, Cercis canadensis, Halesia carolina, Carya cordiformis, Aralia spinosa, Bumelia lanuginosa, Fraxinus americana, Prunus mexicana, Quercus lyrata, Quercus Shumardii, Ulmus crassifolia, Zanthoxylum Clava-Herculis. Sabal minor, not included in column totals, had a density of 4.76 individuals per plot and a frequency of 81.7%.

Table 76. Size classes (dbh) of plant species located in Community 34.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Quercus nigra	21	6	2	3	2	1	1	1	2	
Liquidambar Styraciflua	21	12	11	5	1	2	1			
Quercus falcata	22	11	3	2			3			
Ilex decidua	66									
Celtis laevigata	25	6	3	6		1				
Carya illinoinensis	24	13	7	1						
Halesia diptera	58	1								
Gleditsia triacanthos	35	5	2	2						
Ulmus alata	31	12	2							
Ulmus americana*	13		2	5	2					
Others**	235	26	14	4	2	1		1	1	
Total	551	92	46	28	7	5	5	2	3	

* May include U. rubra.

** See Table 75 for a list of other species present.

Table 77. Frequency, density and dominance data for plant species located in Community 35.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Crataegus spp.	51.7	21.8	1.22	30.5	2.7	55.0
Ulmus crassifolia	32.0	13.5	0.42	10.4	27.3	51.2
Ilex decidua	33.3	14.0	0.60	15.1	1.3	30.4
Gleditsia triacanthos	29.3	12.4	0.52	13.1	4.3	29.8
Quercus Phellos	8.0	3.4	0.10	2.5	18.8	24.7
Celtis laevigata	11.7	4.9	0.13	3.3	12.8	21.0
Diospyros virginiana	20.7	8.7	0.39	9.8	1.0	19.5
Quercus velutina	4.0	1.7	0.04	1.1	12.0	14.8
Fraxinus pensylvanica	12.3	5.2	0.13	3.3	5.8	14.3
Quercus lyrata	3.7	1.5	0.04	0.9	9.8	12.2
Others**		12.8	0.41	10.0	4.0	26.8
Total	----	99.9	4.00	100.0	99.8	299.7

* Sum of relative frequency, relative density and relative dominance.

** Other species present listed in order of decreasing importance values: Carya aquatica, Ilex vomitoria, Ulmus americana (may include U. rubra), Morus rubra, Crataegus spathulata, Quercus nigra, Liquidambar Styraciflua, Halesia diptera, Carya Illinoinensis, Crataegus Marshallii, Acer rubrum, Bumelia lanuginosa, Carpinus caroliniana, Sapindus Saponaria, Citrus trifoliata, Taxodium distichum, Pinus taeda, Quercus falcata. Sabal minor, not included in column totals, had a density of 1.74 individuals per plot.

Table 78. Size classes (dbh) of plant species located in Community 35.

Species	Size Classes (cm)								
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Crataegus spp.	364	2								
Ulmus crassifolia	44	40	25	16						
Ilex dedidua	181									
Gleditsia triacanthos	141	13	2	1						
Quercus Phellos	20		1		2	4	2	1		
Celtis laevigata	16		18	4	2					
Diospyros virginiana	117	1								
Quercus velutina	6	1			2	3	1			
Fraxinus pensylvanica	32	1		7						
Quercus lyrata	2	1		3	2	3				
Others*	108	5	2	3						
Total	1031	64	48	34	8	10	3	1		

* See Table 77 for a list of other species present.

Table 79. Frequency, density and dominance data for plant species located in Community 36.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Nyssa aquatica	81.3	36.7	2.43	49.6	72.6	158.9
Taxodium distichum	34.9	15.8	0.51	10.3	24.0	50.1
Fraxinus caroliniana	31.3	14.1	0.53	10.8	0.6	25.5
Itea virginica	24.2	10.9	0.61	12.3	0.1	23.3
Acer rubrum	15.1	6.8	0.38	7.7	0.9	15.4
Planera aquatica	10.0	4.5	0.13	2.6	0.2	7.3
Liquidambar Styraciflua	3.5	1.6	0.04	0.9	1.1	3.6
Fraxinus pensylvanica	4.2	1.9	0.07	1.4	0.2	3.5
Carya aquatica	2.9	1.3	0.06	1.2	0.1	2.6
Quercus lyrata	3.6	1.6	0.04	0.8	0.2	2.6
Others**		4.9	0.17	2.0	0.1	7.0
Total	----	100.1	4.97	99.6	100.1	299.8

* Sum of relative frequency, relative density and relative dominance.

** Other species present listed in order of decreasing importance values: Ulmus americana (may include U. rubra), Styrax americana, Cephalanthus occidentalis, Celtis laevigata, Quercus Phellos, Cornus racemosa, Diospyros virginiana, Quercus falcata, Callicarpa americana, Carpinus caroliniana, Gleditsia aquatica, Ilex decidua, Ilex opaca, Ilex vomitoria, Quercus nigra, Quercus Shumardii, Ulmus crassifolia. Sabal minor, not included in column totals, had a density of 0.07 individuals per plot.

Table 80. Size classes (dbh) of plant species located in Community 36.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Nyssa aquatica	679	318	122	74	54	34	19	14	6	19
Taxodium distichum	83	63	41	28	24	16	12	9	1	1
Fraxinus caroliniana	283	7								
Itea virginica	333									
Acer rubrum	188	12	6	2						
Planera aquatica	66	2	1							
Liquidambar Styraciflua	12	2	4	2	2	2				
Fraxinus pensylvanica	33	5		1						
Carya aquatica	31	1								
Quercus lyrata	18	2		1						
Others*	61	3								
Total	1787	415	174	108	80	52	31	23	7	20

* See Table 79 for a list of other species present.

but instead appeared to be spring fed with drainage into Big Creek. A drainage ditch has also been excavated from the east end of Smith Break to the Trinity River. Dominant woody species in Smith Break were tupelo and bald cypress (Table 81). Each of these species showed good size class distribution (Table 82). Subdominants in this site were water elm (Planera aquatica) and common buttonbush (Cephalanthus occidentalis).

Both Smith Break and The Break were dominated by tupelo and bald cypress but subdominant species varied in the two sites (Tables 79 and 81). In the areas studied, The Break had a greater species diversity as indicated by the larger number of species recorded (27 species as compared to 10 in Smith Break). The Break, in addition, averaged 4.97 plants per plot whereas Smith Break averaged 1.53.

Community 38

Community 38, located adjacent to Smith Break (Fig. 18), contained a fairly open forest with little underbrush. Trees were generally scattered as indicated by the presence of 1.95 individuals per plot. In addition, the study plots transected a slough as evidenced by the occurrence of water hickory (Carya aquatica), water locust (Gleditsia aquatica), swamp privet (Forestiera acuminata) and water elm

Dominant trees in the area were cedar elm, willow oak, hawthorn and honey locust (Table 83). Trees of overcup oak and Texas sugarberry were also prevalent. Willow oak, overcup oak and green ash were the only species with representatives having diameters greater than 50 cm (Table 84). There were 24 species recorded in plots at this site.

Community 39

Community 39 contained a preponderance of water elm (Table 85). The more abundant associated species were common buttonbush, water locust and swamp privet. Nine species were recorded in this swamp with an average occurrence of a little over 9 shrubs or trees per plot. Most shrubs and trees had dbh less than 20 cm (Table 86).

Community 40

Of the communities studied, Community 40 is nearest the Trinity River (Fig. 18). The topography was generally flat with an occasional slough. The area was fairly

Table 81. Frequency, density and dominance data for plant species located in Community 37.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Nyssa aquatica	20.3	19.4	0.32	21.0	70.9	111.3
Taxodium distichum	25.3	24.2	0.32	20.6	26.7	71.5
Planera aquatica	25.9	24.8	0.38	24.9	1.3	51.0
Cephalanthus occidentalis	16.9	16.1	0.28	18.6	0.3	35.0
Fraxinus pensylvanica	5.0	4.8	0.06	3.9	0.2	8.9
Sesbania Drummondii	4.7	4.5	0.07	4.3	**	8.8
Forestiera acuminata	3.8	3.6	0.07	4.3	0.3	8.2
Gleditsia aquatica	2.2	2.1	0.03	2.0	0.2	4.3
Quercus lyrata	0.3	0.3	***	0.2	**	0.5
Quercus Phellos	0.3	0.3	***	0.2	**	0.5
Total	----	100.1	1.53	100.0	99.9	300.0

* Sum of relative frequency, relative density and relative dominance.

** Less than 0.1.

*** Less than 0.01.

Table 82. Size classes (dbh) of plant species located in Community 37.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Nyssa aquatica	6	10	9	11	10	10	17	9	5	16
Taxodium distichum	8	14	27	18	12	11	6	3		2
Planera aquatica	108	13	1							
Cephalanthus occidentalis	91									
Fraxinus pensylvanica	13	6								
Sesbania Drummondii	21									
Forestiera acuminata	21									
Gleditsia aquatica	8		2							
Quercus lyrata	1									
Quercus Phellos	1									
Total	278	43	39	29	22	21	23	12	5	18

Table 83. Frequency, density and dominance data for plant species located in Community 38.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Ulmus crassifolia	26.3	18.5	0.36	18.5	23.8	60.8
Quercus Phellos	14.0	9.9	0.14	7.2	41.3	58.4
Crataegus spp.	25.0	17.6	0.46	23.6	1.2	42.4
Gleditsia triacanthos	20.0	14.1	0.32	16.6	2.8	33.5
Quercus lyrata	6.7	4.7	0.08	3.9	11.4	20.0
Celtis laevigata	9.3	6.6	0.10	5.0	4.7	16.3
Ilex decidua	9.7	6.8	0.13	6.5	0.5	13.8
Carya aquatica	6.7	4.7	0.07	3.6	2.6	10.9
Fraxinus pensylvanica	4.3	3.1	0.05	2.4	4.4	9.9
Diospyros virginiana	5.0	3.5	0.06	2.9	0.1	6.5
Others**		10.3	0.18	9.6	7.3	27.2
Total	----	99.8	1.95	99.8	100.1	299.7

* Sum of relative frequency, relative density and relative dominance.

** Other species present listed in decreasing order of importance values: Crataegus Marshallii, Quercus falcata, Carya illinoinensis, Gleditsia aquatica, Quercus nigra, Ulmus americana (may include U. rubra), Morus rubra, Ulmus alata, Crataegus spathulata, Liquidambar Styraciflua, Quercus Prinus, Forestiera acuminata, Planera aquatica, Sesbania Drummondii.

Table 84. Size classes (dbh) of plant species located in Community 38.

Species	Size Classes (cm)								
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Ulmus crassifolia	50	22	23	10	3					
Quercus Phellos	1	5	9	14	3	6	3	1		
Crataegus spp.	135	2	1							
Gleditsia triacanthos	87	7	2	1						
Quercus lyrata	2	11	3	4	1	1	1			
Celtis laevigata	13	6	10							
Ilex decidua	38									
Carya aquatica	9	11	1							
Fraxinus pensylvanica	6	3	2	2		1				
Diospyros virginiana	16	1								
Others*	41	10	1	2	3					
Total	398	78	52	33	10	8	4	1		

* See Table 83 for a list of other species present.

Table 85. Frequency, density and dominance data for plant species located in Community 39.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Planera aquatica	86.0	37.1	3.32	36.2	76.7	150.0
Cephalanthus occidentalis	74.0	31.9	4.56	49.8	4.8	86.5
Gleditsia aquatica	18.0	7.8	0.30	3.3	9.0	20.1
Forestiera acuminata	22.0	9.5	0.58	6.3	1.9	17.7
Diospyros virginiana	15.0	6.5	0.22	2.4	0.8	9.7
Fraxinus pensylvanica	9.0	3.9	0.10	1.1	4.0	9.0
Quercus lyrata	5.0	2.2	0.05	0.5	2.7	5.4
Sesbania Drummondii	2.0	0.9	0.02	0.2	**	1.1
Carya aquatica	1.0	0.4	0.01	0.1	**	0.5
Total	----	100.2	9.16	99.9	99.9	300.0

* Sum of relative frequency, relative density and relative dominance.

** Less than 0.1.

Table 86. Size classes (dbh) of plant species located in Community 39.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Planera aquatica	265	59	8							
Cephalanthus occidentalis	456									
Gleditsia aquatica	12	12	6							
Forestiera acuminata	58									
Diospyros virginiana	21	1								
Fraxinus pensylvanica	5	3		2						
Quercus lyrata	1	2	2							
Sesbania Drummondii	2									
Carya aquatica	1									
Total	821	77	16	2						

evenly dominated by hawthorn, southern red oak, cedar elm, water oak and honey locust (Table 87). Trees of winged-elm (Ulmus alata) and Texas sugarberry were also occasionally encountered. Trees were generally less than 50 cm in diameter (Table 88). Thirty species were recorded at this site and there was an average of 2.62 trees or shrubs per plot.

Combined Swamp Sites (Communities 36 and 37)

When data from The Break and Smith Break were combined, tupelo, bald cypress, Carolina ash and sweet-spire emerged as dominants (Table 89). Tupelo and bald cypress were by far the dominant species in both areas. In Smith Break, however, Carolina ash and sweet-spire were lacking and water elm and common buttonbush replaced these species as subdominants (Table 79 and 81). There was a total of 29 species recorded in both areas.

Combined Terrestrial Sites (Communities 34, 35, 38 and 40)

The overall dominant species within the land communities studied were hawthorn, cedar elm and honey locust. Willow oak, deciduous holly, Texas sugarberry, water oak and southern red oak were also prevalent (Table 90). Cedar elm and hawthorn were among the top three dominants in three of the study sites. Honey locust, while not among the first three dominants on any site, was nevertheless a significant component of all four plant communities (Tables 75, 77, 83 and 87). Fifty-two woody species were found in the terrestrial communities studied.

Table 87. Frequency, density and dominance data for plant species located in Community 40.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Crataegus spp.	27.0	14.4	0.50	19.2	0.7	34.3
Quercus falcata	8.0	4.3	0.09	3.3	24.3	31.9
Ulmus crassifolia	23.7	12.6	0.36	13.7	4.5	30.8
Quercus nigra	9.7	5.2	0.10	3.9	19.3	28.4
Gleditsia triacanthos	24.0	12.8	0.35	13.5	1.6	27.9
Ulmus alata	16.7	8.9	0.26	9.9	4.5	23.3
Celtis laevigata	12.3	6.6	0.14	5.2	9.9	21.7
Crataegus spathulata	15.7	8.3	0.22	8.3	0.2	16.8
Quercus velutina	4.0	2.1	0.06	2.2	6.4	10.7
Ilex decidua	7.7	4.1	0.10	3.8	0.6	8.5
Others**		20.9	0.44	17.0	28.0	65.9
Total	----	100.2	2.62	100.0	100.0	300.2

* Sum of relative frequency, relative density and relative dominance.

** Other species present listed in decreasing order of importance values: Quercus sinuata, Fraxinus pensylvanica, Ulmus americana (may include U. rubra), Quercus Prinus, Crataegus Marshallii, Quercus lyrata, Fraxinus americana, Tilia americana (includes T. caroliniana and T. floridana), Quercus Phellos, Planera aquatica, Cephalanthus occidentalis, Zanthoxylum Clava-Herculis, Bumelia lanuginosa, Liquidambar Styraciflua, Cornus racemosa, Diospyros virginiana, Carya illinoinensis, Carya aquatica, Morus rubra, Ilex vomitoria.

Table 88. Size classes (dbh) of plant species located in Community 40.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Crataegus spp.	150	1								
Quercus falcata	1	4	2	7	6	3	1	2		
Ulmus crassifolia	91	10	6	1						
Quercus nigra		3	11	7	8	2				
Gleditsia triacanthos	99	6	1							
Ulmus alata	52	25	1							
Celtis laevigata	6	16	16	3						
Crataegus spathulata	65									
Quercus velutina		4	8	4	1					
Ilex decidua	27	1	2							
Others*	65	27	29	8	4					
Total	556	97	76	30	19	5	1	2		

* See Table 87 for a list of other species present.

Table 89. Summary of frequency, density and dominance data for plant species located in Communities 36 and 37.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Nyssa aquatica	58.9	32.9	1.66	45.2	72.1	150.2
Taxodium distichum	31.4	17.6	0.44	11.9	24.8	54.3
Fraxinus caroliniana	19.8	11.1	0.33	9.1	0.4	20.6
Itea virginica	15.3	8.6	0.38	10.4	**	19.0
Planera aquatica	15.9	8.9	0.22	6.0	0.5	15.4
Acer rubrum	9.5	5.3	0.24	6.5	0.6	12.4
Cephalanthus occidentalis	7.0	3.9	0.11	3.1	0.1	7.1
Fraxinus pensylvanica	4.5	2.5	0.07	1.8	0.2	4.5
Liquidambar Styraciflua	2.2	1.2	0.03	0.8	0.8	2.8
Quercus lyrata	2.4	1.4	0.03	0.7	0.1	2.2
Others***		6.8	0.14	4.2	0.3	11.3
Total	----	100.2	3.65	99.7	99.9	299.8

* Sum of relative frequency, relative density and relative dominance.

** Value less than 0.1.

*** Other species present listed in order of decreasing importance values: Carya aquatica, Sesbania Drummondii, Forestiera acuminata, Ulmus americana (may include U. rubra), Gleditsia aquatica, Styrax americana, Celtis laevigata, Quercus Phellos,

Table 89. (cont.)
Cornus racemosa, Quercus falcata, Diospyros virginiana, Callicarpa americana, Carpinus caroliniana, Ilex decidua, Ilex opaca, Ilex vomitoria, Quercus nigra, Quercus Shumardii, Ulmus crassifolia. Sabal minor, not included in column totals, had a density of 0.05 individuals per plot.

Table 90. Summary of frequency, density and dominance data for plant species located in Communities 34, 35, 38 and 40.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Crataegus spp.	27.0	14.1	0.56	20.3	1.2	35.6
Ulmus crassifolia	20.6	10.8	0.29	10.3	13.4	34.5
Gleditsia triacanthos	21.5	11.3	0.34	12.2	2.9	26.4
Quercus Phellos	5.8	3.0	0.06	2.3	14.7	20.0
Ilex decidua	17.0	8.9	0.26	9.5	0.9	19.3
Celtis laevigata	10.8	5.6	0.13	4.6	8.9	19.1
Quercus nigra	6.0	3.1	0.06	2.3	11.1	16.5
Quercus falcata	5.2	2.7	0.06	2.1	10.3	15.1
Fraxinus pensylvanica	5.8	3.1	0.06	2.2	4.4	9.7
Ulmus alata	7.3	3.8	0.10	3.8	1.9	9.5
Others**		33.1	0.84	30.0	29.8	92.9
Total	----	99.5	2.76	99.6	99.5	298.6

* Sum of relative frequency, relative density and relative dominance.

** Other species present listed in order of decreasing importance values: Diospyros virginiana, Quercus velutina, Quercus lyrata, Liquidambar Styraciflua, Ulmus americana (may include U. rubra), Carya illinoinensis, Crataegus spathulata, Carya aquatica, Quercus Prinus, Halesia diptera, Ilex vomitoria, Crataegus Marshallii, Callicarpa americana, Carpinus caroliniana, Quercus sinuata, Morus rubra, Ilex opaca, Sambucus

Table 90. (cont.)
canadensis, Viburnum dentatum, Cornus racemosa, Fraxinus americana, Tilia americana (includes T. caroliniana and T. floridana), Acer rubrum, Nyssa sylvatica, Planera aquatica, Gleditsia aquatica, Bumelia lanuginosa, Cephalanthus occidentalis, Zanthoxylum Clava-Herculis, Cercis canadensis, Halesia carolina, Taxodium distichum, Sapindus Saponaria, Aralia spinosa, Carya cordiformis, Citrus trifoliata, Forestiera acuminata, Pinus taeda, Prunus mexicana, Quercus Shumardii, Sesbania Drummondii. Sabal minor, not included in column totals, had a density of 1.33 individuals per plot.

STUDY AREA 9

Introduction

The objective of this phase of the study was to characterize the woody vegetation associated with the Tanner Bayou and Capers Ridge areas (Fig. 19). Field work was accomplished during the fall of 1972. The study area was situated within Liberty County in southeast Texas near the junction of State Highway 162 and the Trinity River. The study area was located on the west side of the river (Fig. 19).

Topographically, the study area is generally flat. Several lakes, swamps and sloughs were present, the most obvious of which were Gaylor Lake and Mud Lake. The area is drained by Tanner Bayou, Little Bayou and Gaylor Creek. The river terrace extends from near Gaylor Lake southward to Capers Ridge where it projects eastward along Capers Ridge almost to the Trinity River.

Geologically, most of the study area is composed of Alluvium deposits of Recent origin. Marginal elevated areas were part of the Deweyville Formation whereas outcrops of the Beaumont Formation comprised the crest of Capers Ridge. The Deweyville Formation is of Recent or Pleistocene origin while the Beaumont Formation is of Pleistocene origin. All deposits are within the Quaternary Period.

Soil surveys were incomplete in regard to the study area and, as a result, some extrapolations have been made. Based on available information, there appeared to be four major soil types present. These were Kaufman clay, Forestdale silt loam, Acadia silt loam and Tuckerman loam. The most extensive soil was the Kaufman clay. The Kaufman clay soils occupy the somewhat poorly drained bottomland floodplain areas. They are suited primarily for pond reservoir areas and woodland and wetland wildlife (U. S. Department of Agriculture, unpublished data). They have some potential for grassland. The Forestdale silt loam soils were slightly elevated above and generally bordering the Kaufman clay soils. Drainage is slow and ponding occurs in depressions. They are poorly suited for dwellings but offer a fair potential for cropland and grassland. Woodland production is favorable. The most elevated sites in the study area contained Acadia silt loam soils. The Acadia soils are highly productive for woodland, suited for wildlife but exhibit only a fair potential for cropland and pasture. They are poorly suited for dwellings. The Tuckerman soils occupy nearly level concave areas

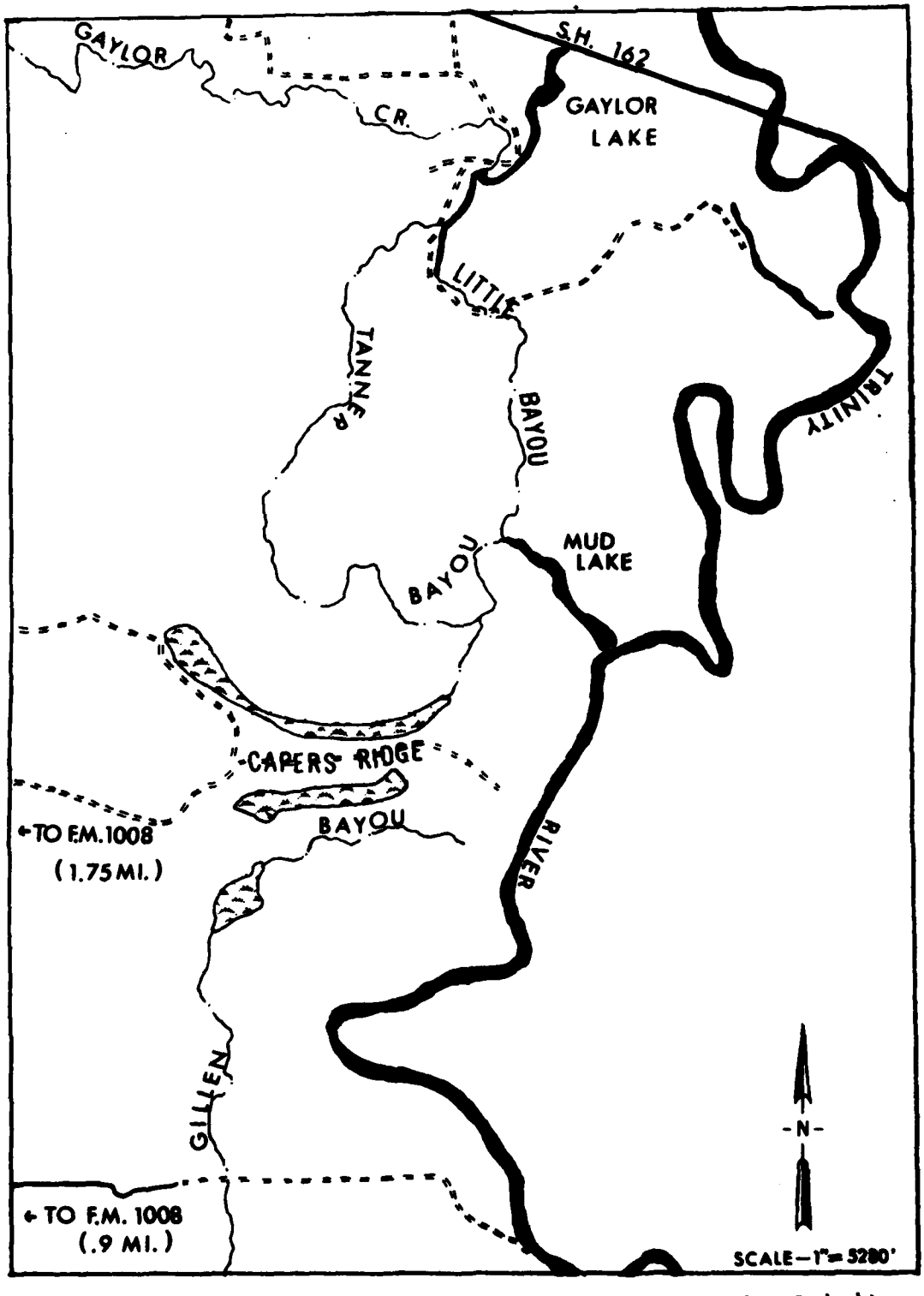


Fig. 19. Showing the study area in relation to the Trinity River.

and are generally poorly drained and ponded. They are poorly suited for dwellings, general recreation use, cropland or grassland but are suited for pond reservoir areas and wetland wildlife.

The vegetation of the study area was mostly bottomland hardwood forest. Bordering, higher elevated areas supported some pines and other upland species. Cleared areas were few and generally associated with roads and pipelines. Cattle grazed most of the area and past logging was evident.

Land Use

Liberty County had a population of 33,014 in 1970, about half of which resided in the county's four largest towns (Texas Almanac, 1971). The economy is based on agribusiness, varied light industry, tourism, and employment in the Houston metropolitan area. Oil, gas, sulfur, sand and gravel are produced within the county. Agriculture, based mainly on rice and cattle, contributes $15 million annually to the economy. Sales of timber within the county total about $2 million annually.

With no National Forests or other reserved land within its boundaries, less than one-thirtieth of Liberty County's 756,480 acres was classified in 1967 as urban and other non-commercial area (Table 91) (Liberty County Conservation Needs Committee, 1970). Of the commercial land area, 60% is forested. Between 1958 and 1967, the acreage of forest within the county increased slightly, probably as a result of a change in the boundary with Harris County which increased the total land area of Liberty County.

Of the approximately 270,000 acres devoted to agriculture about 54% is in cropland. In 1958, cropland acreage was predicted to increase roughly 9,000 acres by 1975, but by 1967 had declined 20,000 acres (Liberty County Conservation Needs Committee, 1958 and 1970). Pastureland, predicted to increase only 4,000 acres between 1958 and 1975, had already jumped 15,000 acres by 1967. The classification "other land", including building sites, lawns, barnyards, farm roads, etc., was expected to increase from about 1,200 acres in 1958 to slightly less than 1,800 acres in 1975. Land devoted to these uses, however, had increased spectacularly to just under 8,100 acres by 1967.

While it will remain an important major land use, cropland acreage will likely continue to decrease in the

Table 91. Liberty County land area (in acres).
(from Liberty County Conservation Needs Committee, 1970)

Land Use	1958	1967
Total land area*	750,590	756,480
Less: Federal non-cropland	0	0
Less: Urban and built-up	24,366	24,666
Less: Small water areas	6	136
Total non-commercial area	24,372	24,802
Total commercial farm and forest area	726,218	731,678
Cropland	164,293	144,465
Pasture**	110,462	125,539
Forest	450,280	453,600
Other land	1,183	8,074

* Different acreage because of boundary change between Liberty and Harris counties.

** Includes 18,349 acres of open range in 1958, none in 1967.

near future. Marginal and fallow cropland will probably be converted to improved pasture, a pattern common to all of East Texas. It appears that forests will decline, generally being converted to improved pasture and weekend home sites.

Although the 8,074 acres devoted to "other land" uses in 1967 was hardly more than 1% of the county's area, its jump from only 1,183 acres in 1958 was unexpected, and the trend visibly continues. The boom in vacation and weekend home construction, with attendant roads and other facilities, accounts for most of the increase. Larger and more elaborate developments will continue to draw permanent residents willing to commute to jobs in Houston and Beaumont. The concentration of new housing developments on the limited amount of land along the Trinity River and nearby oxbow lakes magnifies the impact beyond that indicated by acreage figures alone.

Development has also begun in the Tanner Bayou-Capers Ridge vicinity. Weekend houses have already been built on Gaylor Lake. A large, expensive development just across Highway 162 is the fastest growing in Liberty County. Across the river from Capers Ridge is Knight's Forest, another large development. In addition, construction has been started on a road which will eventually parallel and open for development a portion of the river front to the east of Gaylor Lake.

The county's appraisal of potential for outdoor recreational development (Anonymous, 1966) rates it medium-high for vacation cabins, cottages, and homesites. It has high potential for picnic and field sport use, as well as some appeal for campers. Despite poorly drained soils, terrain too flat for water impoundments, frequent rain and the abundance of mosquitoes, the heavily wooded scenery along the Trinity River within an hour's drive of Houston and Beaumont appeals to outdoor recreation seekers.

Methods and Procedures

Seven study sites were selected within the Tanner Bayou and Capers Ridge areas (Figs. 20, 21 and 22). The more undisturbed plant communities were selected representing variable vegetative types present. Transects were positioned within each study site as indicated in Figures 20, 21 and 22. A total of 1,700 plots (5 meter square) were analyzed. Three hundred plots were analyzed in each study site with the exceptions of Community 46 (100 plots) and Community 47 (100 plots).

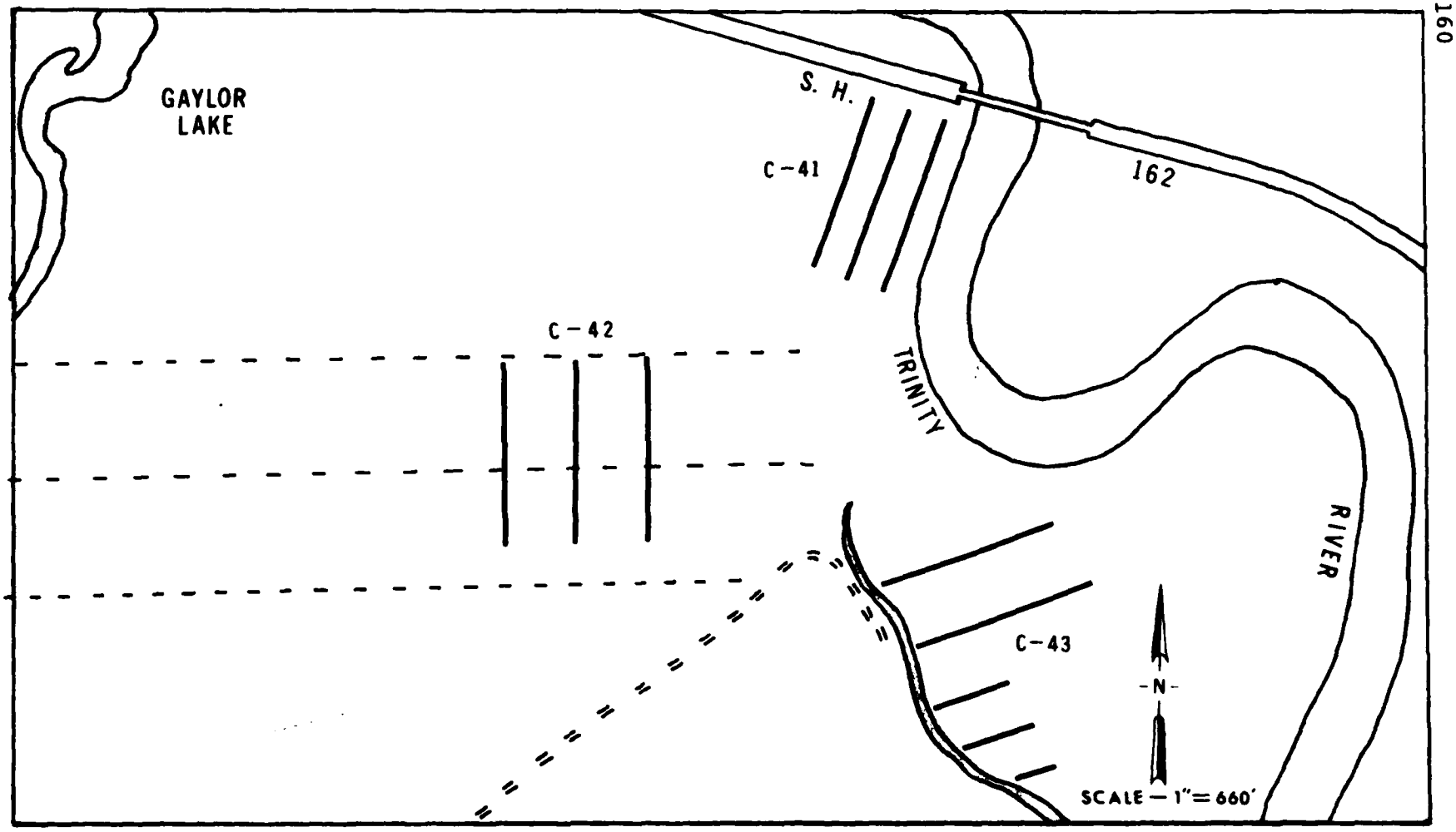


Fig. 20. Location of Communities 41, 42 and 43 (C-41, C-42 and C-43) and position of study transects (solid lines).

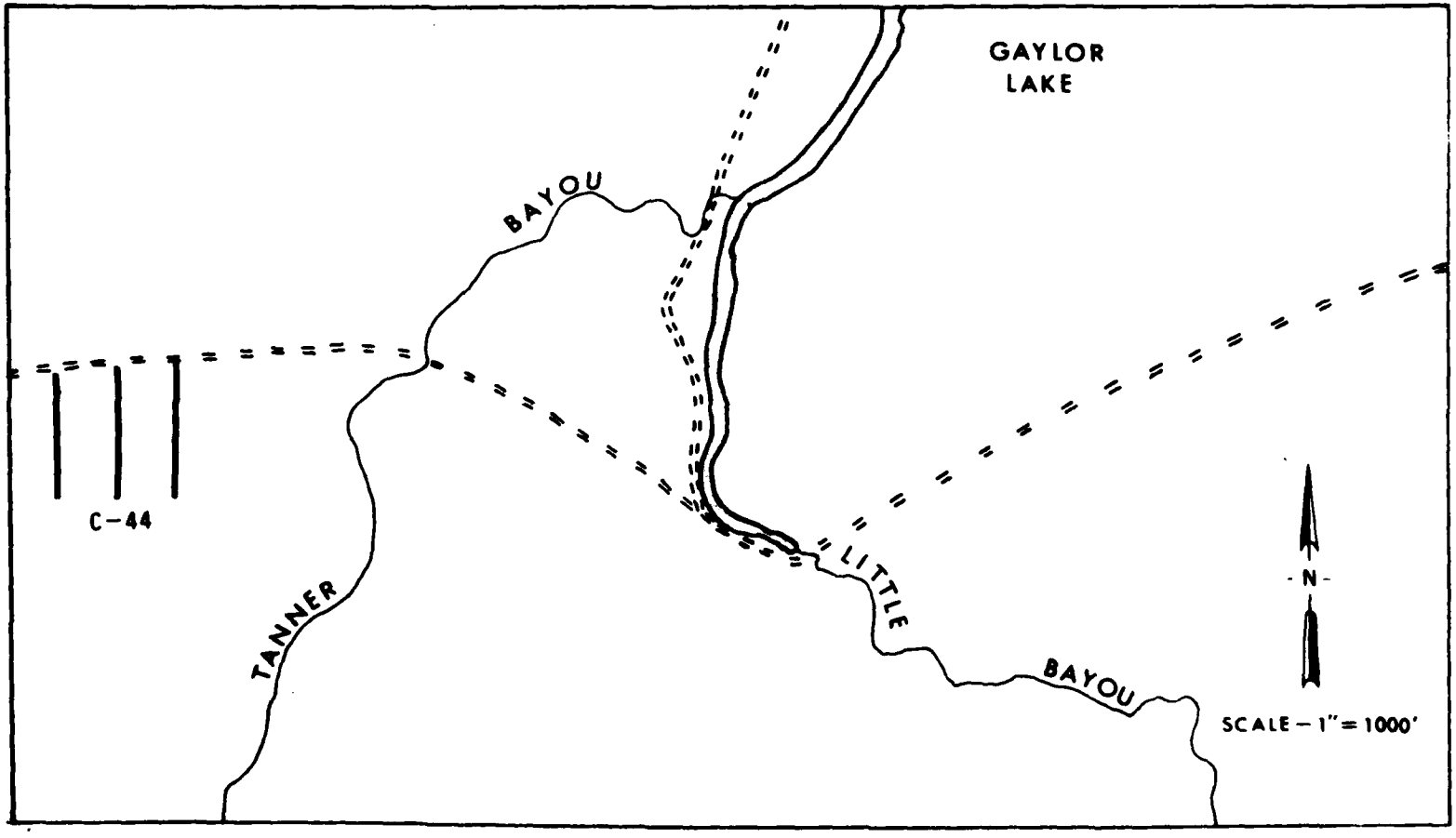


Fig. 21. Location of Community 44 (C-44) and position of study transects (solid lines).

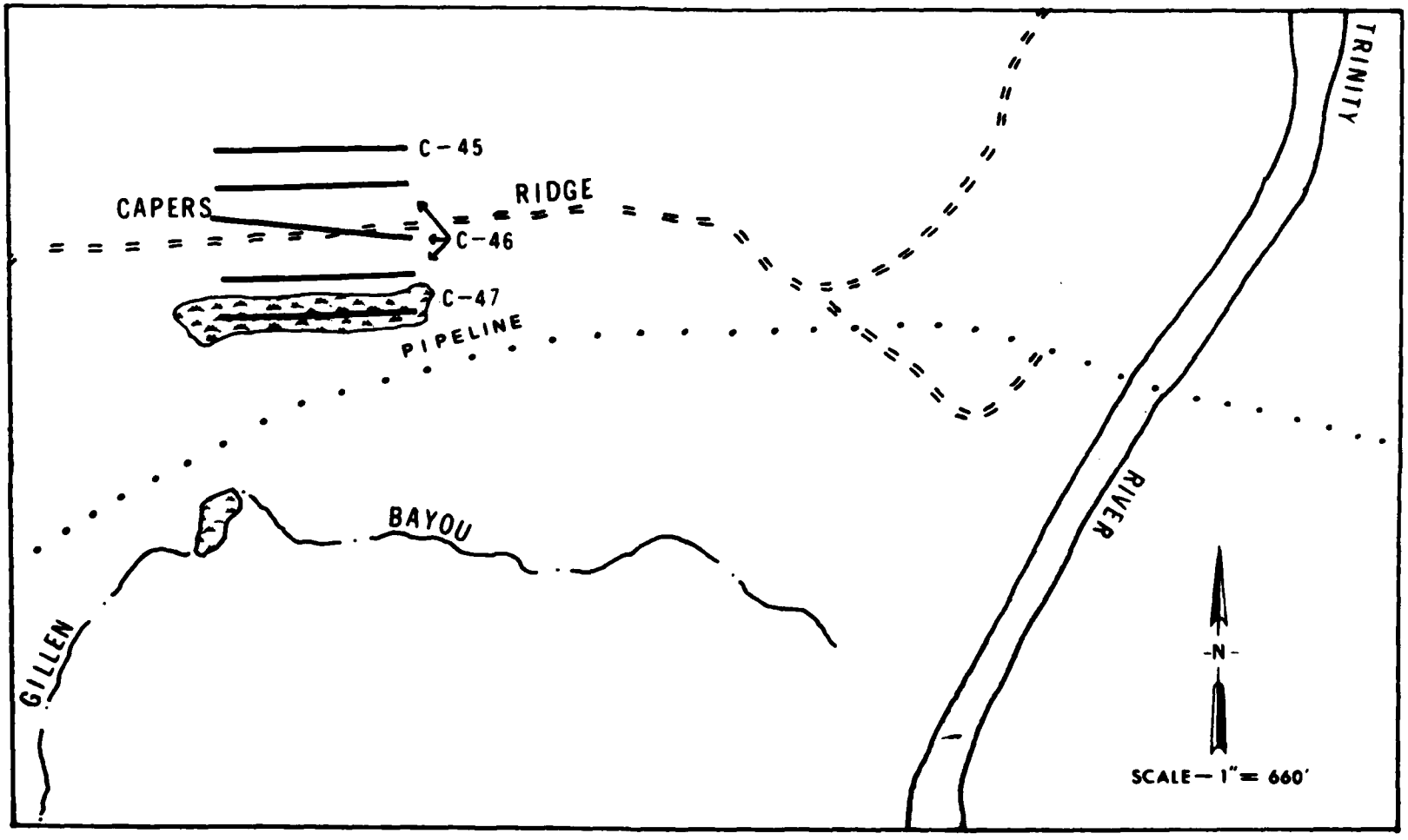


Fig. 21. Location of Communities 45, 46 and 47 (C-45, C-46 and C-47) and position of study transects (solid lines).

Description of Study Sites

Communities 41 and 42 were located near the junction of Highway 162 and the Trinity River (Fig. 20). These sites were on Kaufman clay soils and were generally flat. Community 43 was situated north of a slough near the river (Fig. 20). The topography was flat to slightly rolling and the soils were Kaufman clay. Community 44 was located in a vegetational ecotone associated with a terrace area west of Gaylor Lake (Fig. 21). Topography varied from steeply sloping ravines to generally flat conditions. Soils present included Forestdale silt loam, Acadia silt loam and Kaufman clay. Community 45 was a flat bottomland at the north base of Capers Ridge (Fig. 22). This community was probably situated on the Kaufman clay soil. Community 46 comprised transects in association with Capers Ridge. One transect followed the ridge whereas the other two transects were on north- and south-facing slopes respectively. The soils were probably Forestdale silt loam and Acadia silt loam. The ridge gently slopes from an elevation of 99 feet to an elevation of 35 feet. Community 47 was a swamp at the foot of the south slope and was probably on the Tuckerman loam soil.

Results

Community 41

The predominant woody species at Community 41 based on importance value, were Texas sugarberry (Celtis laevigata) and pecan (Carya illinoinensis) (Table 92). Both were well distributed and displayed good size class distribution (Table 93). Dogwood (Cornus racemosa), swamp privet (Forestiera acuminata), and water elm (Planera aquatica) were also prevalent. Stem size (dbh) for these species, however, was generally between 1 and 20 cm. Larger trees of sweetgum (Liquidambar Styraciflua) and sycamore (Platanus occidentalis) were frequently observed (Table 93). There were 27 species of woody plants with dbh of 1 cm or greater recorded within this study site.

Community 42

Cedar elm (Ulmus crassifolia), Texas sugarberry and water oak (Quercus nigra) were the principal woody species at Community 42 (Table 94). Other associated dominant species were winged-elm (Ulmus alata), deciduous holly (Ilex decidua) and bastard oak (Quercus sinuata). The forest at Community 42 was generally composed of trees with dbh less than 40 cm (Table 95). Only occasionally were larger trees observed and these were usually

Table 92. Frequency, density and dominance data for plant species located in the Tanner Bayou area near Highway 162, Community 41.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Celtis laevigata	35.3	21.9	0.53	19.7	22.2	63.8
Carya illinoinensis	26.3	16.4	0.32	11.9	34.2	62.5
Cornus racemosa	15.0	9.3	0.30	11.1	2.4	22.8
Forestiera acuminata	12.0	7.5	0.27	10.2	2.8	20.5
Planera aquatica	7.7	4.8	0.31	11.5	2.0	18.3
Liquidambar Styraciflua	6.0	3.7	0.09	3.5	9.5	16.7
Ilex decidua	10.7	6.6	0.19	7.1	1.0	14.7
Crataegus spp.	11.0	6.8	0.15	5.5	0.5	12.8
Ulmus crassifolia	10.0	6.2	0.14	5.1	1.5	12.8
Platanus occidentalis	2.7	1.7	0.03	1.2	8.8	11.7
Others**		15.1	0.34	12.6	15.0	42.7
Total	----	100.0	2.67	99.4	99.9	299.3

* Sum of relative frequency, relative density and relative dominance.

** Other species present listed in order of decreasing importance values: Fraxinus pensylvanica, Ulmus americana (may include Ulmus rubra), Sambucus canadensis, Acer Negundo, Diospyros virginiana, Quercus velutina, Gleditsia triacanthos, Quercus lyrata, Quercus nigra, Quercus falcata, Ulmus alata, Taxodium distichum, Cephalanthus occidentalis, Tilia americana (includes T. caroliniana and T. floridana), Ostrya virginiana, Bumelia lanuginosa, Morus rubra.

Table 93. Size classes (dbh) of plant species located in the Tanner Bayou area near Highway 162, Community 41.

Species	Size Classes (cm)								
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Celtis laevigata	29	89	33	6	1					
Carya illinoinensis	8	28	25	22	10	2				
Cornus racemosa	75	13	1							
Forestiera acuminata	73	9								
Planera aquatica	84	8								
Liquidambar Styraciflua	5	5	11	3	2	2				
Ilex decidua	55	2								
Crataegus spp.	40	4								
Ulmus crassifolia	32	7	2							
Platanus occidentalis		1		4	3		2			
Others*	80	13	2	3	4	1	1	1		
Total	481	179	74	38	20	5	3	1		

* See Table 92 for a list of other species present.

Table 94. Frequency, density and dominance data for plant species located in the Tanner Bayou area near Highway 162, Community 42.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Ulmus crassifolia	55.7	15.0	1.28	18.8	8.2	42.0
Celtis laevigata	40.3	10.8	0.76	11.1	18.3	40.2
Quercus nigra	23.7	6.4	0.34	5.0	23.8	35.2
Ulmus alata	36.7	9.9	0.60	8.8	5.0	23.7
Ilex decidua	32.7	8.8	0.64	9.4	2.4	20.6
Quercus sinuata	13.7	3.7	0.22	3.3	9.6	16.6
Crataegus spp.	22.0	5.9	0.50	7.4	0.7	14.0
Quercus falcata	12.0	3.2	0.18	2.7	8.0	13.9
Gleditsia triacanthos	19.0	5.1	0.28	4.1	3.1	12.3
Crataegus Marshallii	21.0	5.6	0.37	5.5	0.5	11.6
Others**		25.4	1.64	23.8	20.2	69.4
Total	----	99.8	6.81	99.9	99.8	299.5

* Sum of relative frequency, relative density, and relative dominance.

** Other species present listed in order of decreasing importance values: Arundinaria gigantea, Fraxinus americana, Fraxinus pensylvanica, Ulmus americana (may include Ulmus rubra), Sapindus Saponaria, Ilex vomitoria, Bumelia lanuginosa, Quercus Phellos, Quercus lyrata, Diospyros virginiana, Cornus racemosa, Quercus velutina, Carya illinoinensis, Morus rubra, Prunus caroliniana, Carya texana, Tilia americana, (includes T. caroliniana and T. floridana), Crataegus spathulata.

Table 95. Size classes (dbh) of plant species located in the Tanner Bayou area near Highway 162, Community 42.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Ulmus crassifolia	352	19	8	4						
Celtis laevigata	162	27	29	8		1				
Quercus nigra	35	30	15	15	5	1				
Ulmus alata	148	26	5							
Ilex decidua	189	2								
Quercus sinuata	45	11	5	4		1		1		
Crataegus spp.	148	2								
Quercus falcata	35	7	6	5	2					
Gleditsia triacanthos	73	5	5	1						
Crataegus Marshallii	112									
Others*	423	35	18	11	4					
Total	1722	164	91	48	11	3		1		

* See Table 94 for a list of other species present.

representatives of Texas sugarberry, water oak, bastard oak and southern red oak (Quercus falcata). There were 28 species of woody plants recorded at Community 42.

Community 43

The overstory woody vegetation in Community 43 consisted chiefly of Texas sugarberry and sweetgum (Table 96). Trees of these species ranged up to 60 cm in diameter (Table 97). Pecan, bald cypress (Taxodium distichum) and water oak were also prevalent and showed good size class distribution. The largest trees recorded were those of water oak. Other dominant species including deciduous holly, dogwood, cedar elm, winged-elm and American elm (Ulmus americana) were generally small in size with most plants representative of the 1-10 cm size class (Table 97). A total of 37 species occurred at Community 43.

Community 44

There were 54 species recorded at Community 44. The more varied topography of this area is the likely cause of its greater species diversity. Two transects were run on a slope and one on a flat bottomland. The upper part of the slope was dominated by yaupon (Ilex vomitoria), sweetgum and eastern hophornbeam (Ostrya virginiana). Associated prevalent species were American beautyberry (Callicarpa americana), blue beech (Carpinus caroliniana), southern magnolia (Magnolia grandiflora) and loblolly pine (Pinus taeda). The middle-slope area was composed primarily of blue beech. Other principal species were sweetgum, southern magnolia, American beautyberry, yaupon, eastern hophornbeam, winged-elm and southern red oak. The dominant tree species in the flat bottomland area were blue beech, cedar elm, chestnut oak (Quercus Prinus) and sweetgum. Other prevalent species included water oak, Texas sugarberry, southern red oak, red maple (Acer rubrum) and honey locust (Gleditsia triacanthos).

Table 98 is a summary of the slope and bottomland transect results at Community 44 and indicates that blue beech, sweetgum, yaupon and southern magnolia were the overall dominants. Eastern hophornbeam, American beauty-berry, and cedar elm were also prevalent. Tree diameters were generally within the 1-10 cm size class (Table 99). Large trees of sweetgum, southern magnolia, southern red oak, chestnut oak, water oak and loblolly pine were occ-asionally encountered.

Table 96. Frequency, density and dominance data for plant species located in the Tanner Bayou area near Highway 162, Community 43.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Celtis laevigata	33.3	16.8	0.44	15.5	24.6	56.9
Liquidambar Styraciflua	27.3	13.8	0.47	16.5	16.8	47.1
Carya illinoinensis	17.3	8.7	0.22	7.7	13.7	30.1
Ilex decidua	25.3	12.8	0.33	11.8	0.8	25.4
Quercus nigra	6.0	3.0	0.06	2.1	12.6	17.7
Cornus racemosa	10.0	5.0	0.19	6.7	1.1	12.8
Taxodium distichum	4.0	2.0	0.07	2.4	7.4	11.8
Ulmus crassifolia	10.3	5.2	0.12	4.1	1.0	10.3
Ulmus americana**	8.7	4.4	0.11	4.0	1.5	9.9
Ulmus alata	9.0	4.5	0.13	4.5	0.8	9.8
Others***		23.8	0.68	24.7	19.8	68.3
Total	----	100.0	2.82	100.0	100.1	300.1

* Sum of relative frequency, relative density and relative dominance.

** May include Ulmus rubra.

*** Other species present listed in order of decreasing importance values: Crataegus spp., Fraxinus pensylvanica, Planera aquatica, Quercus velutina, Diospyros virginiana, Cephalanthus occidentalis, Arundinaria gigantea, Ilex opaca, Quercus lyrata, Tilia americana (includes T. caroliniana and T. floridana), Carya aquatica, Quercus falcata,

Table 96. (cont.)
Fraxinus americana, Morus rubra, Bumelia lanuginosa, Quercus similis, Gleditsia triacanthos, Acer Negundo, Quercus Prinus, Salix nigra, Gleditsia aquatica, Forestiera acuminata, Nyssa sylvatica, Zanthoxylum Clava-Herculis, Crataegus spathulata, Callicarpa americana, Sambucus canadensis.

Table 97. Size classes (dbh) of plant species located in the Tanner Bayou area near Highway 162, Community 43.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Celtis laevigata	49	38	34	11	7	2				
Liquidambar Styraciflua	67	36	26	9	2					
Carya illinoinensis	21	22	10	6	4	2				
Ilex decidua	100									
Quercus nigra	9	2	2	1		1	1		2	
Cornus racemosa	52	5								
Taxodium distichum	5	4	3	5	1	2				
Ulmus crassifolia	34				1					
Ulmus americana*	33					1				
Ulmus alata	32	5	1							
Others**	156	22	14	10	5	3				
Total	558	134	90	42	20	11	1		2	

* May include Ulmus rubra.

** See Table 96 for a list of other species present.

Table 98. Frequency, density and dominance data for plant species located in the Tanner Bayou area west of Gaylor Lake, Community 44.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Carpinus caroliniana	59.0	13.6	1.61	18.7	10.7	43.0
Liquidambar Styraciflua	34.7	8.0	0.57	6.7	17.7	32.4
Ilex vomitoria	40.0	9.2	1.24	14.4	1.3	24.9
Magnolia grandiflora	6.0	1.4	0.07	0.9	18.6	20.9
Ostrya virginiana	26.3	6.1	0.54	6.2	3.7	16.0
Callicarpa americana	31.0	7.1	0.60	7.0	0.2	14.3
Ulmus crassifolia	22.3	5.1	0.62	7.2	0.6	12.9
Quercus falcata	15.7	3.6	0.21	2.4	5.9	11.9
Celtis laevigata	24.0	5.5	0.51	6.0	0.4	11.9
Quercus Prinus	7.3	1.7	0.08	0.9	9.1	11.7
Others**		38.7	2.56	29.6	31.9	100.2
Total	----	100.0	8.61	100.0	100.1	300.1

* Sum of relative frequency, relative density, and relative dominance.

** Other species present listed in order of decreasing importance values: Ulmus alata, Quercus nigra, Pinus taeda, Arundinaria gigantea, Crataegus spp., Sambucus canadensis, Ilex decidua, Juglans nigra, Ulmus americana (may include Ulmus rubra), Fraxinus pensylvanica, Ilex opaca, Fraxinus americana, Sassafras albidum, Crataegus Marshallii, Carya aquatica, Morus rubra, Gleditsia triacanthos, Quercus velutina, Quercus alba,

Table 98. (cont.)
Tilia americana (includes T. caroliniana and T. floridana), Nyssa sylvatica, Cornus florida, Diospyros virginiana, Carya tomentosa, Quercus lyrata, Quercus Phellos, Zanthoxylum Clava-Herculis, Forestiera ligustrina, Crataegus spathulata, Viburnum dentatum, Vaccinium arboreum, Cornus racemosa, Bumelia lanuginosa, Aralia spinosa, Platanus occidentalis, Quercus similis, Taxodium distichum, Rhus copallina, Forestiera acuminata, Cornus Drummondii, Carya illinoinensis, Persea Borbonia, Acer rubrum, Symplocos tinctoria.

Table 99. Size classes (dbh) of plant species located in the Tanner Bayou area west of Gaylor Lake, Community 44.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Carpinus caroliniana	426	34	21	1						
Liquidambar Styraciflua	109	28	18	10	7					
Ilex vomitoria	351									
Magnolia grandiflora	3		7	3	5	2	2			
Ostrya virginiana	136	19	5	1						
Callicarpa americana	180									
Ulmus crassifolia	182	4								
Quercus falcata	48	7	2	1	2	2				
Celtis laevigata	154									
Quercus Prinus	18				1	2	2	1		
Others*	727	23	14	12	6	6	2		1	
Total	2334	115	67	28	21	12	6	1	1	

* See Table 98 for a list of other species present.

Community 45

The bottomland vegetation at Community 45 consisted chiefly of overcup oak (Quercus lyrata), green ash (Fraxinus pensylvanica), hawthorn (Crataegus spp.), water hickory (Carya aquatica) and deciduous holly (Table 100). This site is quite wet during spring and early summer but often is dry during late summer and fall. Twenty-three species were found at Community 45 with representatives generally having stem diameters less than 40 cm (Table 101).

Community 46

The predominant species along the crest of Capers Ridge was yaupon. Trees of sweetgum, Texas sugarberry, and winged-elm were also quite abundant. American beautyberry, which is a shrub, was also frequently encountered. The north slope of Capers Ridge contained a preponderance of giant cane (Arundinaria gigantea). Sweetgum was also dominant. Of lesser abundance was water oak, Texas sugarberry and yaupon. Yaupon was the dominant woody species on the south slope, and along with American beautyberry, dominated the shrub layer. Prevalent tree species comprising the mid- and upper-layers were sweetgum, Texas sugarberry and winged elm. Devil's walking-stick (Aralia spinosa), water oak and black walnut (Juglans nigra) were occasionally observed.

The overall dominants of Community 46 as summarized in Table 102 were yaupon, sweetgum, giant cane, and Texas sugarberry. Winged-elm, water oak, and American beautyberry were prevalent but less frequently encountered. Most woody plants on Capers Ridge had stem diameters between 1 and 10 cm (Table 103). Occasionally, however, large trees of sweetgum, Texas sugarberry, water oak, black walnut, and sycamore (Platanus occidentalis) were observed. There was a good species diversity at Community 46 with 45 woody tree and shrub species being recorded.

Community 47

Community 47 was a small shallow persistent swamp with water depths usually less than 2 feet. Green ash was the predominant species in the swamp (Table 104). Overcup oak and water elm were also frequently recorded. Other associated species were bald cypress and water locust (Gleditsia aquatica). Green ash, overcup oak, bald cypress, and water hickory were the only species with representatives having stem diameters greater than 30 cm (Table 105). Sixteen species were recorded at Community 47.

Table 100. Frequency, density and dominance data for plant species located in a bottomland area north of Capers Ridge, Community 45.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Quercus lyrata	40.0	10.2	0.54	7.2	26.1	43.5
Fraxinus pensylvanica	44.0	11.2	1.27	16.8	11.4	39.4
Crataegus spp.	46.0	11.7	1.27	16.8	4.1	32.6
Carya aquatica	21.0	5.4	0.24	3.2	22.4	31.0
Ilex decidua	49.0	12.5	0.94	12.5	1.5	26.5
Ulmus crassifolia	29.0	7.4	0.61	8.1	4.3	19.8
Gleditsia aquatica	13.0	3.3	0.34	4.5	7.2	15.0
Quercus velutina	18.0	4.6	0.27	3.6	5.9	14.1
Cephalanthus occidentalis	21.0	5.4	0.47	6.2	2.3	13.9
Diospyros virginiana	22.0	5.6	0.35	4.6	3.3	13.5
Others**		23.1	1.24	16.2	11.7	51.0
Total	----	100.4	7.54	99.7	100.2	300.3

* Sum of relative frequency, relative density, and relative dominance.

** Other species present listed in order of decreasing importance values: Celtis laevigata, Planera aquatica, Amorpha fruticosa, Ulmus americana (may include Ulmus rubra), Taxodium distichum, Gleditsia triacanthos, Quercus Phellos, Forestiera acuminata, Pinus taeda, Liquidambar Styraciflua, Ulmus alata, Bumelia lanuginosa, Morus rubra.

Table 101. Size classes (dbh) of plant species located in a bottomland area north of Capers Ridge, Community 45.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Quercus lyrata	35	5	9	3			2			
Fraxinus pensylvanica	121	1		3	2					
Crataegus spp.	126	1								
Carya aquatica	4	4	6	10						
Ilex decidua	94									
Ulmus crassifolia	58		1	2						
Gleditsia aquatica	19	13	2							
Quercus velutina	20	5		1	1					
Cephalanthus occidentalis	46	1								
Diospyros virginiana	26	9								
Others*	110	9	4		1					
Total	659	48	22	19	4		2			

* See Table 100 for a list of other species present.

Table 102. Frequency, density and dominance data for plant species located on Capers Ridge, Community 46.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Ilex vomitoria	66.0	14.1	2.32	20.6	9.1	43.8
Liquidambar Styraciflua	34.3	7.3	0.63	5.6	28.9	41.8
Arundinaria gigantea	24.0	5.1	2.48	22.1	1.0	28.2
Celtis laevigata	47.3	10.1	0.89	7.9	8.8	26.8
Ulmus alata	42.3	9.0	0.88	7.9	2.5	19.4
Quercus nigra	22.0	4.7	0.34	3.0	10.4	18.1
Callicarpa americana	43.3	9.2	0.85	7.6	0.4	17.2
Juglans nigra	10.0	2.1	0.12	1.1	5.9	9.1
Ulmus americana**	20.0	4.3	0.25	2.2	1.6	8.1
Aralia spinosa	14.7	3.1	0.39	3.4	1.4	7.9
Others***		30.7	2.07	18.6	30.2	79.5
Total	----	99.7	11.22	100.0	100.2	299.9

* Sum of relative frequency, relative density, and relative dominance.

** May include Ulmus rubra.

*** Other species present listed in order of decreasing importance values: Fraxinus americana, Sambucus canadensis, Ilex opaca, Bumelia lanuginosa, Quercus falcata, Tilia americana (includes T. caroliniana and T. floridana), Quercus velutina, Quercus Prinus,

Table 102. (cont.)
Platanus occidentalis, Morus rubra, Magnolia grandiflora, Gleditsia triacanthos, Prunus caroliniana, Ilex decidua, Cornus florida, Ulmus crassifolia, Quercus similis, Nyssa sylvatica, Persea Borbonia, Diospyros virginiana, Vaccinium arboreum, Zanthoxylum Clava-Herculis, Viburnum rufidulum, Quercus alba, Fraxinus pensylvanica, Carya illinoinensis, Crataegus spp., Sassafras albidum, Carya aquatica, Prunus serotina, Crataegus spathulata, Prunus mexicana, Rhus copallina, Melia azedarach, Chionanthus virginicus.

Table 103. Size classes (dbh) of plant species located on Capers Ridge, Community 46.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Ilex vomitoria	687	9								
Liquidambar Styraciflua	111	45	11	11	7	2	2			
Arundinaria gigantea	745									
Celtis laevigata	252	3	2	5	3	1				
Ulmus alata	258	3	3	1						
Quercus nigra	70	18	5	5	2		1			
Callicarpa americana	256									
Juglans nigra	16	7	10	2	1					
Ulmus americana*	69	4		2						
Aralia spinosa	113	3								
Others**	538	53	22	7	4	4	1			
Total	3115	145	53	33	17	7	4			

* May include Ulmus rubra.

** See Table 102 for a list of other species present.

Table 104. Frequency, density and dominance data for plant species located in a swamp south of Capers Ridge, Community 47.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Fraxinus pensylvanica	56.0	21.0	1.42	32.8	55.8	109.6
Quercus lyrata	46.0	17.2	0.73	16.9	12.1	46.2
Planera aquatica	50.0	18.7	0.84	19.4	3.3	41.4
Taxodium distichum	19.0	7.1	0.20	4.6	10.4	22.1
Gleditsia aquatica	22.0	8.2	0.26	6.0	6.9	21.1
Quercus velutina	25.0	9.4	0.34	7.9	2.3	19.6
Carya aquatica	11.0	4.1	0.12	2.8	7.5	14.4
Cephalanthus occidentalis	15.0	5.6	0.17	3.9	0.1	9.6
Ulmus americana**	10.0	3.7	0.11	2.5	0.2	6.4
Diospyros virginiana	4.0	1.5	0.05	1.2	0.2	2.9
Others***		3.5	0.09	1.9	1.1	6.5
Total	----	100.0	4.33	99.9	99.9	299.8

* Sum of relative frequency, relative density, and relative dominance.

** May include Ulmus rubra.

*** Other species present listed in order of decreasing importance values: Styrax americana, Liquidambar Styraciflua, Amorpha fruticosa, Ilex decidua, Quercus falcata, Celtis laevigata.

Table 105. Size classes (dbh) of plant species located in a swamp south of Capers Ridge, Community 47.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Fraxinus pensylvanica	118	2	3	6	10	2	1			
Quercus lyrata	63	5	2	2		1				
Planera aquatica	80	4								
Taxodium distichum	12	6	1					1		
Gleditsia aquatica	13	8	5							
Quercus velutina	28	6								
Carya aquatica	3	6	1	2						
Cephalanthus occidentalis	17									
Ulmus americana*	11									
Diospyros virginiana	5									
Others**	8		1							
Total	358	37	13	10	10	3	1	1		

* May include Ulmus rubra.

** See Table 104 for a list of other species present.

STUDY AREA 10

Introduction

Study Area 10 was located just to the north of the junction of the Liberty-Chambers county line and the Trinity River. More specifically, the study communities were situated between Lake Granada and Lake Charlotte. Field analyses were accomplished during the spring of 1974.

The topography of the study sites was generally flat with occasional sloughs and depressions. Swamps were fairly common. Geologically the area is composed of Alluvium deposits of Recent origin within the Quaternary Period. Soils data were not available for Study Area 10 at the time of this study. It is likely that all of the study communities have been selectively logged in the past and, with the exception of swamp areas, cattle were presently grazing.

Land use data for Liberty County was presented in connection with Study Area 9 and, therefore, will not be included in this section.

Methods and Procedures

Ten study communities (Communities 48-57) comprised Study Area 10. The location of these communities and the position of study transects therein, is presented in Figures 23 and 24. A total of 1806 plots (5 meters square) were analyzed with 214 located in Community 48, 202 in Community 49, 210 in Community 50, 200 in Community 51, 102 in Community 52, 210 in Community 53, 64 in Community 54, 204 in Community 55, and 200 each in Communities 56 and 57.

Description of Study Sites

Community 48 was located on the bank of the Trinity River to the west of Lake Granada (Fig. 23). It was a terrestrial site with a relatively flat topography. Community 49 was situated south of Lake Granada on the east tip of the first large bend of the river (Fig. 23). The area was generally flat with a slightly higher elevation near the banks of the river. Community 50 was located on the west bend to the river (Fig. 23) and had about the same site characteristics as Community 49. Communities 51 and 52 were directly south of Community 50 (Fig. 23). Both were transected by shallow erosional waterways but the general topography was flat. Communities 53, 54 and 55 were

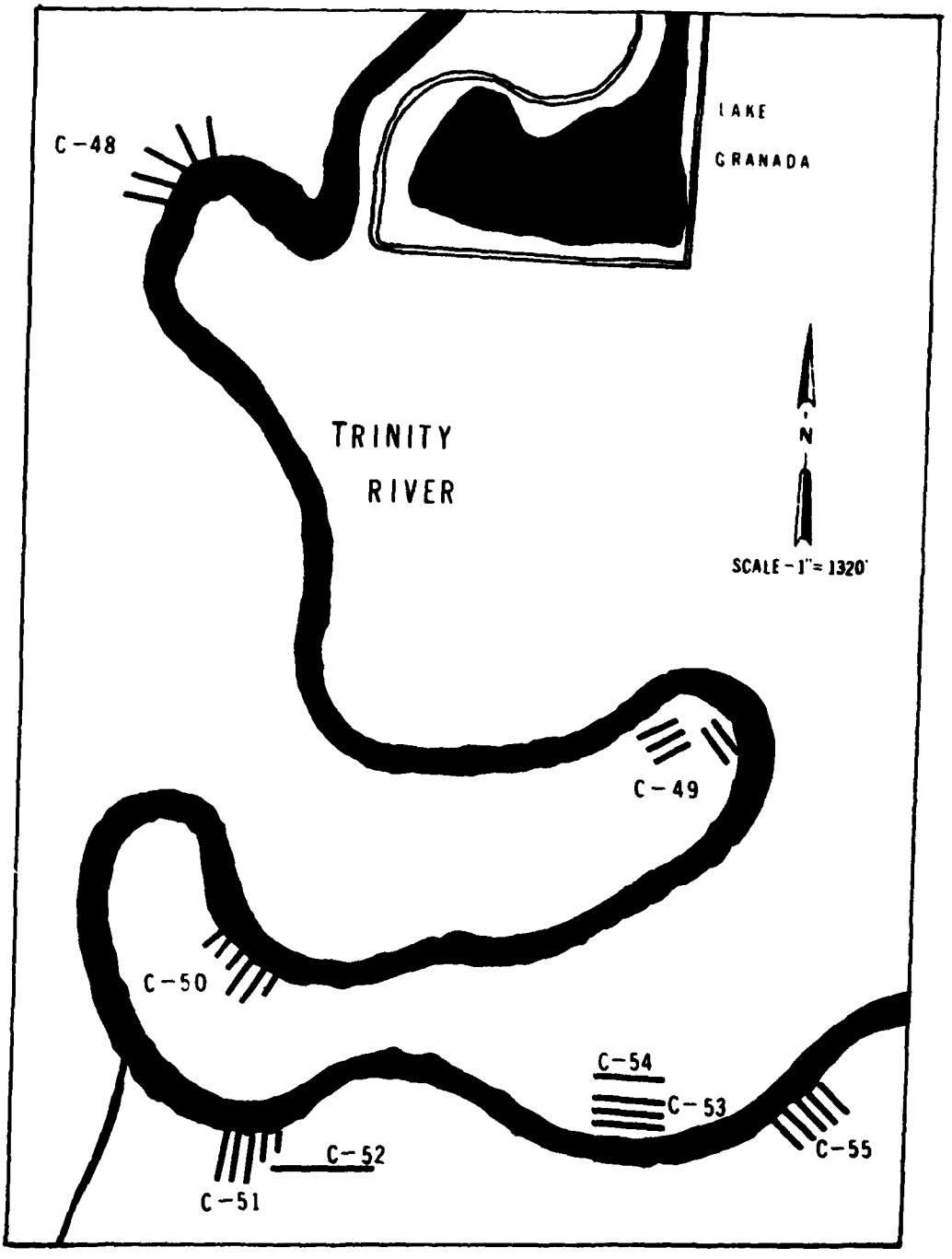


Fig. 23. Location of Communities 48, 49, 50, 51, 52, 53, 54 and 55 (C-48, C-49, C-50, C-51, C-52, C-53, C-54 and C-55) and position of study transects (solid lines).

west of Communities 51 and 52 (Fig. 23). Community 53 was situated on a flat area between the bank of the river and a swamp. Community 54 was a swamp whereas Community 55 was a relatively flat, terrestrial site. Communities 56 (a swamp site) and 57 (a terrestrial site) were associated with Mae Lake (Fig. 24). The topography of these communities was generally flat. All of the areas appeared to be grazed by livestock at present and to have been selectively logged in the past.

Result

Community 48

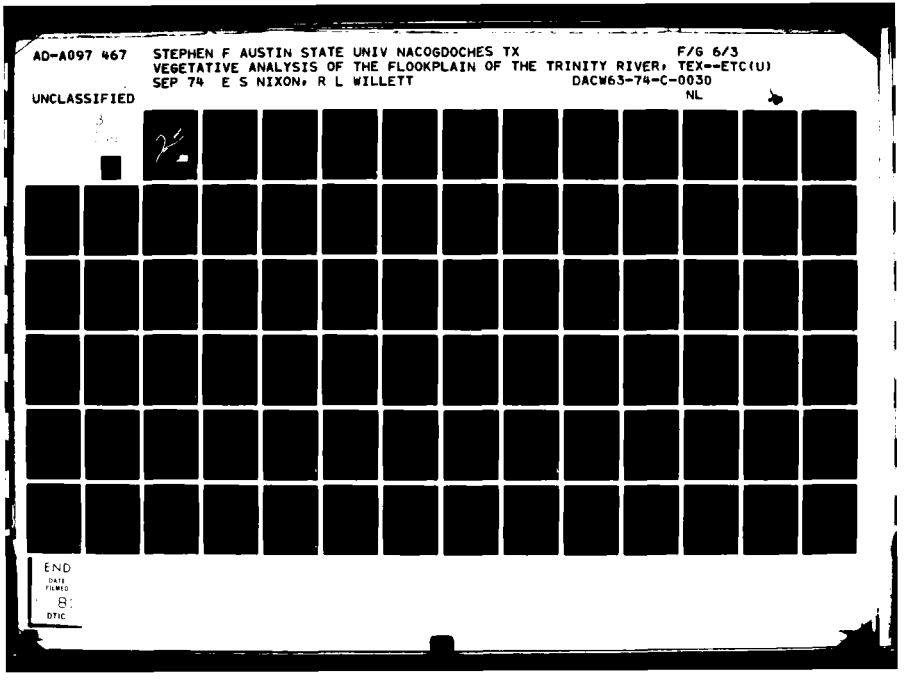
Two species, green ash (Fraxinus pensylvanica) and bald cypress (Taxodium distichum), dominated Community 48 (Table 106). Other less prevalent species were sycamore (Platanus occidentalis), black willow (Salix nigra) and Chinese tallow tree (Sapium sebiferum). The community was characterized by an open understory with an average of only 2.64 plants per plot. Although the community was terrestrial, many aquatic species were present (Table 106). A total of 21 species were recorded and the community had a fairly good size class distribution (Table 107).

Community 49

Community 49 was a fairly open forest with an average of about 3 shrubs or trees per plot (Table 108). A total of 20 species were recorded. The community was composed primarily of green ash in association with Texas sugarberry (Celtis laevigata), sycamore and water hickory (Carya aquatica) (Table 108). Some rather large trees were scattered throughout the area (Table 109).

Community 50

Community 50 sloped very gently downward from the bank of the river to a nearby cypress swamp. The occurrence of bald cypress as the second dominant species attests to the more hydric nature of this site. Green ash was the principal species of this community and, in addition to bald cypress, Texas sugarberry, sycamore and water hickory were also prevalent (Table 110). There were 24 species recorded in this community averaging 2.68 plants per plot. Size class distribution of representatives of these species is presented in Table 111.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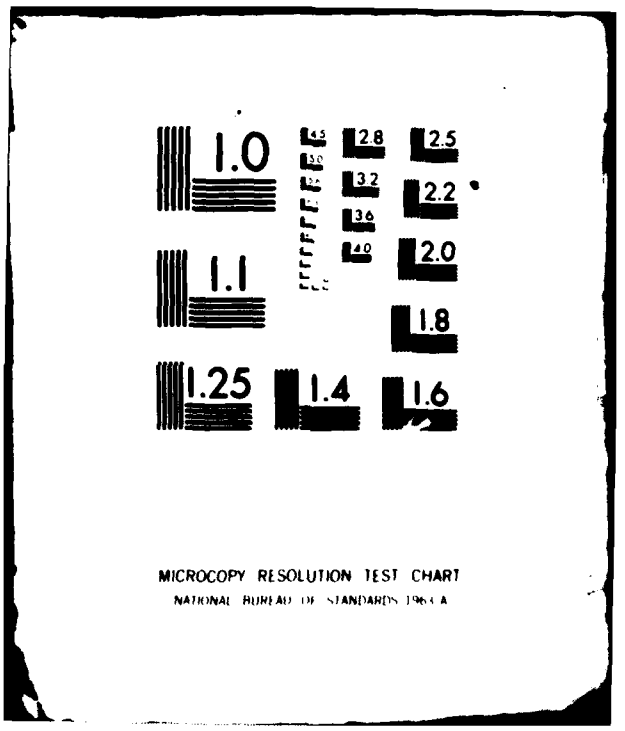
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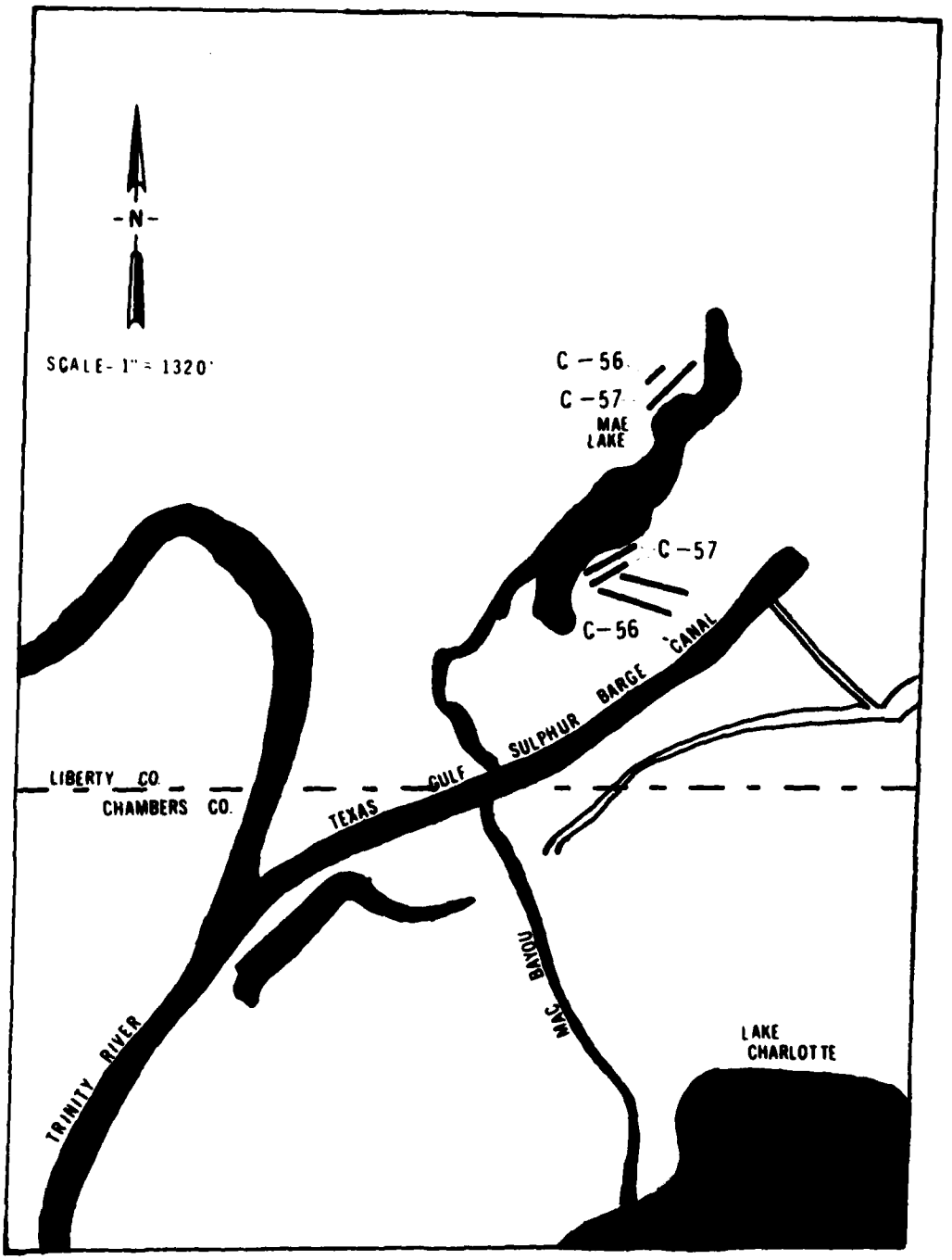

Fig. 24. Location of Communities 56 and 57 (C-56 and C-57) and position of transects (solid lines).

Table 106. Frequency, density and dominance data for plant species located in Community 48.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Fraxinus pensylvanica	22.0	13.2	0.36	13.5	45.1	71.8
Taxodium distichum	39.3	23.6	0.77	28.8	14.7	67.1
Platanus occidentalis	14.5	8.7	0.22	8.4	8.7	25.8
Salix nigra	7.9	4.8	0.09	3.3	16.4	24.5
Sapium sebiferum	17.8	10.7	0.36	13.5	0.1	24.3
Celtis laevigata	11.7	7.0	0.15	5.8	2.1	14.9
Diospyros virginiana	9.8	5.9	0.17	6.3	0.3	12.5
Planera aquatica	9.3	5.6	0.12	4.5	1.8	11.9
Carya aquatica	7.9	4.8	0.09	3.5	3.0	11.3
Crataegus spp.	7.0	4.2	0.10	3.7	0.3	8.2
Others**	19.3	11.6	0.21	8.7	7.5	27.8
Total	----	100.1	2.64	100.0	100.0	300.1

* Sum of relative frequency, relative density and relative dominance.

** Other species present listed in order of decreasing importance values: Quercus lyrata, Forestiera acuminata, Rubus spp., Liquidambar Styraciflua, Gleditsia aquatica, Ilex decidua, Ulmus crassifolia, Sambucus canadensis, Populus deltoides, Ulmus americana (may include U. rubra), Gleditsia triacanthos, Carya illinoinensis.

Table 107. Size classes (dbh) of plant species located in Community 48.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Fraxinus pensylvanica	5	20	26	18	5	2			1	
Taxodium distichum	99	38	20	6	2					
Platanus occidentalis	10	22	10	5	1					
Salix nigra		1		7	6	2	3			
Sapium sebiferum	77									
Celtis laevigata	25	3	3	2						
Diospyros virginiana	34	2								
Planera aquatica	11	13	1							
Carya aquatica	6	7	6		1					
Crataegus spp.	19	2								
Others*	26	11	8	6	1					
Total	312	119	74	44	16	4	3		1	

* See Table 106 for a list of other species present.

Table 108. Frequency, density and dominance data for plant species located in Community 49.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Fraxinus pensylvanica	30.7	15.8	0.40	13.5	62.2	91.5
Celtis laevigata	68.8	35.4	1.07	36.4	4.3	76.1
Platanus occidentalis	17.8	9.2	0.40	13.6	19.9	42.7
Carya aquatica	18.3	9.4	0.23	7.7	6.4	23.5
Forestiera acuminata	12.9	6.6	0.25	8.6	0.4	15.6
Ulmus americana**	11.9	6.1	0.13	4.8	2.1	13.0
Crataegus spp.	9.4	4.8	0.13	4.4	0.3	9.5
Diospyros virginiana	5.4	2.8	0.07	2.4	0.1	5.3
Acer Negundo	4.0	2.0	0.06	2.0	1.2	5.2
Carya illinoinensis	3.0	1.5	0.02	0.8	1.2	3.5
Others***		6.7	0.13	5.7	1.7	14.1
Total	----	100.3	2.89	99.9	99.8	300.0

* Sum of relative frequency, relative density and relative dominance.

** May include U. rubra.

*** Other species present listed in order of decreasing importance values: Salix nigra, Taxodium distichum, Ulmus crassifolia, Quercus lyrata, Cornus florida, Sapium sebiferum, Cornus Drummondii, Populus deltoides, Sambucus canadensis, Bumelia lanuginosa.

Table 109. Size classes (dbh) of plant species located in Community 49.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Fraxinus pennsylvanica	17	11	14	25	13	1			1	
Celtis laevigata	194	15	2	4		1				
Platanus occidentalis	34	20	11	12	2		1		1	
Carya aquatica	12	18	9	4	2		1			
Forestiera acuminata	48	3								
Ulmus americana*	21	2	3	1			1			
Crataegus spp.	25		1							
Diospyros virginiana	12	2								
Acer Negundo	2	6	3	1						
Carya illinoinensis	1	1		2	1					
Others**	19	2	2	4						
Total	385	80	45	53	18	2	3		2	

* May include U. rubra.

** See Table 108 for a list of other species present.

Table 110. Frequency, density and dominance data for plant species located in Community 50.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Fraxinus pensylvanica	28.6	15.0	0.37	13.5	43.8	72.3
Taxodium distichum	36.2	19.0	0.65	23.8	12.8	55.6
Platanus occidentalis	18.6	9.8	0.40	14.5	16.1	40.4
Celtis laevigata	24.8	13.0	0.32	11.7	5.1	29.8
Carya aquatica	12.9	6.8	0.17	6.1	6.6	19.5
Ulmus crassifolia	11.9	6.3	0.17	6.3	2.1	14.7
Crataegus spp.	11.4	6.0	0.13	4.7	0.3	11.0
Salix nigra	3.8	2.0	0.04	1.6	7.3	10.9
Ilex decidua	9.0	4.8	0.11	4.2	0.3	9.3
Forestiera acuminata	8.6	4.5	0.10	3.7	1.0	9.2
Others**		13.3	0.22	10.2	4.8	28.3
Total	----	100.5	2.68	100.3	100.2	301.0

* Sum of relative frequency, relative density and relative dominance.

** Other species present listed in order of decreasing importance values: Ulmus americana (may include U. rubra), Planera aquatica, Diospyros virginiana, Quercus Shumardii, Populus deltoides, Gleditsia triacanthos, Liquidambar Styraciflua, Sapindus Saponaria, Bumelia lanuginosa, Gleditsia aquatica, Citrus trifoliata, Morus rubra, Quercus Iyrata, Styrax americana, Sambucus canadensis.

Table 111. Size classes (dbh) of plant species located in Community 50.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Fraxinus pensylvanica	5	11	26	12	11	9	3			
Taxodium distichum	90	24	13	7	2					
Platanus occidentalis	34	26	11	6	2	4				
Celtis laevigata	46	11	8	1	1					
Carya aquatica	4	23	3	4	1					
Ulmus crassifolia	25	8	3							
Crataegus spp.	26	1								
Salix nigra			2	3	2	2				
Ilex decidua	24									
Forestiera acuminata	16	5								
Others*	38	11	4	3						
Total	308	120	70	36	19	15	3			

* See Table 110 for a list of other species present.

Community 51

Community 51 was a rather dense canopied, unlayered forest with an open understory. Bush palmetto (Sabal minor) was scattered throughout. The topography was generally flat but several shallow erosional waterways transected the site. The overwhelming dominant woody species in this community was green ash (Table 112). Plants of common elder-berry (Sambucus canadensis), American elm and Texas sugarberry were occasionally recorded. There was an average of about 5 plants per plot and a total of 22 species in this community. Tree dbh were usually less than 40 cm (Table 113).

Community 52

The topography of Community 52 was generally flat but several shallow erosional waterways also transected this site. Although the vegetation is indicative of a swamp, the area was not inundated at the time of the study. And from the appearance of the site, it is not likely that the area is inundated for any great length of time. The woody vegetation consisted chiefly of bald cypress in association with water elm (Planera aquatica) and green ash (Table 114). Box elder (Acer Negundo) was also quite prevalent. Stems of the 14 recorded species in this community were generally small (Table 115). There was an average of 3.61 trees and shrubs per plot. Of special note was the occurrence of the trunked form of bush palmetto (Sabal minor) in this community.

Community 53

A fairly dense canopy and the presence of many woody vines characterized Community 53. This community was dominated by sycamore associated with Texas sugarberry, water hickory, green ash and swamp privet (Forestiera acuminata) (Table 116). Sixteen species were recorded and they averaged 2.35 plants per plot. There were several larger trees present but most had dbh less than 40 cm (Table 117).

Community 54

The shallow water swamp site comprising Community 54 was dominated by water elm, green ash, bald cypress and swamp privet (Table 118). Only 12 species were recorded and they averaged a little more than 5 plants per plot. Most of the trees in the community had dbh less than 40 cm (Table 119).

Table 112. Frequency, density and dominance data for plant species located in Community 51.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Fraxinus pensylvanica	73.0	29.5	1.95	41.6	43.3	114.4
Sambucus canadensis	28.5	11.5	0.87	18.6	0.2	30.3
Ulmus americana**	24.0	9.7	0.39	8.1	5.5	23.3
Celtis laevigata	23.5	9.5	0.32	6.8	6.5	22.8
Ulmus crassifolia	17.0	6.9	0.20	4.3	5.9	17.1
Quercus lyrata	14.0	5.7	0.15	3.2	7.5	16.4
Carya aquatica	10.5	4.2	0.12	2.6	8.9	15.7
Ilex decidua	16.5	6.7	0.26	5.6	1.3	13.6
Salix nigra	5.5	2.2	0.06	1.2	8.1	11.5
Quercus Shumardii	6.0	2.4	0.07	1.4	1.9	5.7
Others***		11.6	0.42	6.6	10.9	29.1
Total	----	99.9	4.81	100.0	100.0	299.9

* Sum of relative frequency, relative density and relative dominance.

** May include U. rubra.

*** Other species present listed in order of decreasing importance values: Acer Negundo, Populus deltoides, Platanus occidentalis, Forestiera acuminata, Diospyros virginiana, Liquidambar Styraciflua, Gleditsia aquatica, Taxodium distichum, Planera aquatica, Crataegus spp., Cornus Drummondii, Styrax americana.

Table 113. Size classes (dbh) of plant species located in Community 51.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Fraxinus pensylvanica	248	101	21	9	8	2				
Sambucus canadensis	174									
Ulmus americana*	52	18	6							
Celtis laevigata	50	6	4	4						
Ulmus crassifolia	14	16	9	1						
Quercus lyrata	12	6	8	3	1					
Carya aquatica	4	4	11	1	3					
Ilex decidua	51		1							
Salix nigra			4	4	3					
Quercus shumardii	6	4	3							
Others**	59	13	6	6		1				
Total	670	168	73	28	15	3				

* May include U. rubra.

** See Table 112 for a list of other species present.

Table 114. Frequency, density and dominance data for plant species located in Community 52.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Taxodium distichum	52.9	27.3	1.27	35.3	57.4	120.0
Planera aquatica	45.1	23.2	0.88	24.5	13.0	60.7
Fraxinus pensylvanica	34.3	17.7	0.45	12.5	26.3	56.5
Acer Negundo	31.4	16.2	0.58	16.0	1.5	33.7
Sambucus canadensis	9.8	5.1	0.17	4.6	**	9.7
Forestiera acuminata	6.9	3.5	0.11	3.0	0.3	6.8
Ulmus americana***	3.9	2.0	0.05	1.4	**	3.4
Celtis laevigata	2.9	1.5	0.03	0.8	**	2.3
Gleditsia aquatica	2.0	1.0	0.02	0.5	0.7	2.2
Salix nigra	1.0	0.5	0.01	0.3	0.8	1.6
Others****		2.0	0.04	1.2	0.1	3.3
Total	----	100.0	3.61	100.1	100.1	300.2

* Sum of relative frequency, relative density and relative dominance.

** Less than 0.1.

*** May include U. rubra.

**** Other species present listed in order of decreasing importance values: Quercus lyrata, Styrax americana, Ilex decidua, Cephalanthus occidentalis.

Table 115. Size classes (dbh) of plant species located in Community 52.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Taxodium distichum	15	45	40	21	8					
Planera aquatica	30	59	1							
Fraxinus pensylvanica	3	10	20	11	2					
Acer Negundo	52	7								
Sambucus canadensis	16									
Forestiera acuminata	11									
Ulmus americana*	5									
Celtis laevigata	3									
Gleditsia aquatica		1	1							
Salix nigra				1						
Others**	3	1								
Total	138	123	62	33	10					

* May include U. rubra.

** See Table 114 for a list of other species present.

Table 116. Frequency, density and dominance data for plant species located in Community 53.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Platanus occidentalis	25.7	18.1	0.51	22.0	31.2	71.3
Celtis laevigata	27.6	19.5	0.44	18.7	8.4	46.6
Carya aquatica	18.6	13.1	0.30	12.6	19.0	44.7
Fraxinus pensylvanica	10.5	7.4	0.13	5.5	17.5	30.4
Forestiera acuminata	14.3	10.1	0.35	14.8	3.0	27.9
Diospyros virginiana	12.9	9.1	0.22	9.3	0.7	19.1
Crataegus spp.	9.5	6.7	0.17	7.1	0.3	14.1
Salix nigra	2.4	1.7	0.02	1.0	7.7	10.4
Populus deltoides	0.5	0.3	**	0.2	9.0	9.5
Ulmus americana***	3.8	2.7	0.04	1.6	1.8	6.1
Others****		11.4	0.17	7.0	1.5	19.9
Total	----	100.1	2.35	99.8	100.1	300.0

* Sum of relative frequency, relative density and relative dominance.

** Less than 0.01.

*** May include U. rubra.

**** Other species present listed in order of decreasing importance values: Gleditsia aquatica, Ilex decidua, Ulmus crassifolia, Sapium sebiferum, Taxodium distichum, Bumelia lanuginosa.

Table 117. Size classes (dbh) of plant species located in Community 53.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Platanus occidentalis	31	29	32	13	3					
Celtis laevigata	66	16	7	1	2					
Carya aquatica	4	32	11	13	2					
Fraxinus pensylvanica	1	5	7	9	3	1	1			
Forestiera acuminata	65	8								
Diospyros virginiana	41	5								
Crataegus spp.	35									
Salix nigra				2	2		1			
Populus deltoides									1	
Ulmus americana*	3	2	2	1						
Others**	28	6	1							
Total	274	103	60	39	12	1	2		1	

* May include U. rubra.

** See Table 116 for a list of other species present.

Table 118. Frequency, density and dominance data for plant species located in Community 54.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Planera aquatica	62.5	25.0	1.75	33.9	14.8	73.7
Fraxinus pensylvanica	54.7	21.9	1.13	21.8	23.1	66.8
Taxodium distichum	35.9	14.4	0.52	10.0	34.9	59.3
Forestiera acuminata	45.3	18.1	1.20	23.3	8.0	49.4
Salix nigra	9.4	3.8	0.09	1.8	10.9	16.5
Gleditsia aquatica	7.8	3.1	0.13	2.4	4.5	10.0
Ulmus americana**	9.4	3.8	0.09	1.8	2.0	7.6
Carya aquatica	6.3	2.5	0.06	1.2	1.3	5.0
Celtis laevigata	7.8	3.1	0.08	1.5	.2	4.8
Diospyros virginiana	4.7	1.9	0.05	.9	.2	3.0
Others***		2.6	0.06	1.2	.2	4.0
Total		100.2	5.16	99.8	100.1	300.1

* Sum of relative frequency, relative density and relative dominance.

** May include U. rubra.

*** Other species present listed in order of decreasing importance values: Sapium sebiferum, Cephalanthus occidentalis.

Table 119. Size classes (dbh) of plant species located in Community 54.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Planera aquatica	84	26	2							
Fraxinus pensylvanica	36	24	10	1		1				
Taxodium distichum	4	10	4	11	4					
Forestiera acuminata	64	13								
Salix nigra				6						
Gleditsia aquatica	2	2	3	1						
Ulmus americana*	5			1						
Carya aquatica		4								
Celtis laevigata	5									
Diospyros virginiana	3									
Others**	4									
Total	207	79	19	20	4	1				

* May include U. rubra.

** See Table 118 for a list of other species present.

Community 55

Community 55 was a rather open forest consisting chiefly of green ash in association with water hickory and Texas sugarberry (Table 120). Hawthorn (Crataegus spp.), cedar elm (Ulmus crassifolia) and overcup oak (Quercus lyrata) were somewhat prevalent. A density of less than 2 plants per plot was recorded representing a total of 18 species. Trees generally had dbh less than 40 cm (Table 121).

Community 56

The swamp vegetation comprising Community 56 contained a preponderance of bald cypress (Table 122). The only other species encountered with any frequency were water elm, common buttonbush (Cephalanthus occidentalis) and green ash. There was an average of 2.73 plants per plot and a total of 9 species recorded. With the exception of bald cypress and green ash, trees had dbh less than 40 cm (Table 123).

Community 57

Community 57 was composed primarily of green ash (Table 124). The next 3 dominants were the hydrophytic species bald cypress, water elm and swamp privet indicating that although the forest was terrestrial, a somewhat hydric condition existed. Actually the plot transects were along the shores of Mae Lake (Fig. 24). There was an average density of 5.65 plants per plot and a total of 11 species recorded (Table 124). Only bald cypress and green ash had trees with dbh greater than 40 cm (Table 125).

Table 120. Frequency, density and dominance data for plant species located in Community 55.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Fraxinus pensylvanica	54.9	30.9	1.05	39.7	55.6	126.2
Carya aquatica	27.0	15.2	0.37	14.0	8.4	37.6
Celtis laevigata	22.1	12.4	0.25	9.6	10.8	32.8
Crataegus spp.	16.2	9.1	0.23	8.7	1.4	19.2
Ulmus crassifolia	13.2	7.5	0.18	6.8	4.6	18.9
Quercus lyrata	11.3	6.4	0.13	4.8	7.3	18.5
Ilex decidua	11.8	6.6	0.18	6.8	1.4	14.8
Ulmus americana**	8.8	5.0	0.10	3.7	5.6	14.3
Gleditsia aquatica	2.5	1.4	0.04	1.5	2.4	5.3
Planera aquatica	2.9	1.7	0.04	1.5	0.6	3.8
Others***	7.0	4.0	0.06	3.0	1.7	8.7
Total	----	100.2	2.63	100.1	99.8	300.1

* Sum of relative frequency, relative density and relative dominance.

** May include U. rubra.

*** Other species present listed in order of decreasing importance values: Acer Negundo, Forestiera acuminata, Diospyros virginiana, Taxodium distichum, Rhus toxicodendron, Styrax americana, Bumelia lanuginosa, Platanus occidentalis.

Table 121. Size classes (dbh) of plant species located in Community 55.

Species	Size Classes (cm)									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Fraxinus pensylvanica	17	99	80	23						
Carya aquatica	35	30	9	1						
Celtis laevigata	15	16	19	3						
Crataegus spp.	43	4								
Ulmus crassifolia	8	25	4							
Quercus lyrata	7	12	4	2				1		
Ilex decidua	36	1								
Ulmus americana*	3	9	4	3	1					
Gleditsia aquatica	1	5	1		1					
Planera aquatica	5	3								
Others**	8	6	1	1						
Total	178	210	122	33	2			1		

* May include U. rubra.

** See Table 120 for a list of other species present.

Table 122. Frequency, density and dominance data for plant species located in Community 56.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Taxodium distichum	63.0	44.2	1.20	44.0	84.9	173.1
Planera aquatica	33.0	23.2	0.51	18.7	4.5	46.4
Cephalanthus occidentalis	24.0	16.8	0.67	24.6	1.5	42.9
Fraxinus pensylvanica	16.5	11.6	0.26	9.5	7.8	28.9
Salix nigra	2.5	1.8	0.03	0.9	0.8	3.5
Carya aquatica	2.0	1.4	0.02	0.7	0.4	2.5
Forestiera acuminata	0.5	0.4	0.02	0.6	**	1.0
Quercus lyrata	0.5	0.4	0.01	0.2	0.1	0.7
Ulmus americana***	0.5	0.4	0.01	0.2	**	0.6
Total	----	100.2	2.73	99.4	100.0	299.6

* Sum of relative frequency, relative density and relative dominance.

** Less than 0.1.

*** May include U. rubra.

Table 123. Size classes (dbh) of plant species located in Community 56.

Species	Size Classes (cm)								
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Taxodium distichum	13	46	76	58	15	18	8	6	3	
Planera aquatica	60	40	2							
Cephalanthus occidentalis	128	6								
Fraxinus pensylvanica	7	20	14	6	4					
Salix nigra	2		2	1						
Carya aquatica		3	1							
Forestiera acuminata	3									
Quercus lyrata			1							
Ulmus americana*	1									
Total	214	115	96	65	19	18	8	6	3	

* May include U. rubra.

Table 124. Frequency, density and dominance data for plant species located in Community 57.

Species	Frequency %	Relative frequency %	Density no./plot	Relative density %	Relative dominance %	Importance value*
Fraxinus pensylvanica	69.5	30.3	1.71	30.3	47.3	107.9
Taxodium distichum	31.5	13.8	0.50	8.9	31.4	54.1
Planera aquatica	40.0	17.5	1.61	28.6	4.1	50.2
Forestiera acuminata	31.5	13.8	1.03	18.3	4.5	36.6
Carya aquatica	18.5	8.1	0.30	5.2	4.7	18.0
Salix nigra	11.0	4.8	0.20	3.5	5.3	13.6
Gleditsia triacanthos	17.5	7.6	0.19	3.4	1.6	12.6
Cephalanthus occidentalis	7.5	3.3	0.08	1.4	0.1	4.8
Quercus lyrata	1.0	0.4	0.01	0.2	1.1	1.7
Amorpha fruticosa	0.5	0.2	0.01	0.1	**	0.3
Crataegus spp.	0.5	0.2	0.01	0.1	**	0.3
Total		100.0	5.65	100.0	100.1	300.1

* Sum of relative frequency, relative density and relative dominance.

** Less than 0.1.

Table 125. Size classes (dbh) of plant species located in Community 57.

Species	Size Classes (cm)								
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Fraxinus pensylvanica	58	178	83	21	1					
Taxodium distichum	9	38	24	16	5	6	2			
Planera aquatica	302	17	3							
Forestiera acuminata	196	10								
Carya aquatica	13	41	5							
Salix nigra	4	23	12							
Gleditsia triacanthos	32	2	3	1						
Cephalanthus occidentalis	16									
Quercus lyrata				2						
Amorpha fruticosa	1									
Crataegus spp.	1									
Total	632	309	130	40	6	6	2			

RESULTS (SUMMARY) AND DISCUSSION

A total of 11,977 $(5m)^2$ plots were analyzed within the 10 study areas (57 communities) associated with the floodplain of the Trinity River. These plots contained an average of 4.83 woody plants with dbh greater than 1/2 cm and an overall total of 57,508 plants representing 97 species.

Based on importance value, the 10 most dominant plants in the river floodplain listed in order of decreasing importance values were cedar elm (Ulmus crassifolia) (38.7), Texas sugarberry (Celtis laevigata) (36.8), green ash (Fraxinus pensylvanica) (32.0), tupelo (Nyssa aquatica) (17.3), deciduous holly (Ilex decidua) (15.4), bald cypress (Taxodium distichum) (15.0), hawthorn (Crataegus spp.) (10.5), swamp privet (Forestiera acuminata) (8.3), water elm (Planera aquatica) (6.2) and roughleaf dogwood (Cornus Drummondii) (6.0). The dominance of tupelo and bald cypress is attributed mainly to their large size and thus a high relative dominance whereas deciduous holly, hawthorn and swamp privet had high frequencies and densities. On a frequency basis, Texas sugarberry, hawthorn, green ash, deciduous holly and cedar elm were the most commonly encountered species in plots within the Trinity River floodplain.

Other prevalent species, in addition to the 10 most dominant, were water hickory (Carya aquatica), pecan (Carya illinoinensis), sweetgum (Liquidambar Styraciflua), overcup oak (Quercus lyrata), black willow (Salix nigra) and American elm (Ulmus americana).

When noting the single dominant species of each of the 57 communities, cedar elm, Texas sugarberry and green ash were the dominants in 14, 12 and 11 communities respectively. No other species was dominant in more than 2 communities. When selecting the top 3 dominants in each of the 57 communities, as based on importance value, these same 3 species were the most frequent dominants. Cedar elm was among the top 3 dominants in 31 communities (54%), Texas sugarberry in 28 (49%) and green ash in 25 (44%). Deciduous holly was 1 of 3 dominants in 9 communities, bald cypress in 8, water elm in 7, hawthorn in 6 and swamp privet in 5. Pecan, overcup oak, sweetgum and sycamore were among the top 3 dominants in 4 communities.

To gain a greater insight into the distributional aspects of the species in the Trinity floodplain, presence

data were calculated. Presence, as used in this study, is a measure of the regularity of distribution of a species in different communities of the basin (Phillips, 1959). Only 15 of the 97 recorded species in the Trinity River floodplain had presence values greater than 40%. Green ash (93.0%), Texas sugarberry (89.5%) and cedar elm (84.2%) occurred in over 80% of the 57 communities. These species were generally evenly distributed within the portion of the basin studied from the Dallas-Fort Worth area to the Liberty-Chambers county line. They were also the top 3 dominants. Deciduous holly (78.9%), hawthorn (77.2%), swamp privet (71.9%), American elm (70.2%), gum bumelia (Bumelia lanuginosa) (68.4%) and honey locust (Gleditsia triacanthos) (66.7%) had presence values between 60% and 80%. All displayed a balanced distribution within the basin but American elm, gum bumelia and honey locust were not among the 10 dominant species. Those species with presence values between 40% and 60% were red mulberry (Morus rubra) (59.6%), persimmon (Diospyros virginiana) (59.6%), overcup oak (57.9%), pecan (52.6%), water hickory (43.9%) and soap berry (Sapindus Saponaria) (43.9%). Red mulberry, persimmon and pecan were regularly distributed in the basin whereas overcup oak and water hickory were more uniformly observed in the southern half. Soap berry was more abundant in the northern half. None of these 6 species were representatives of the top 10 dominants of the basin. The remaining 4 dominants of the basin revealed a more restricted distribution. Tupelo (3.5%) occurred in only 2 communities but displayed high frequency and density figures and especially high dominance (basal area) measurements within each community. The high relative dominance figure was most responsible for its position in the top 10 dominants. Bald cypress (31.6%) and water elm (35.1%) were more abundant in the southern portion of the basin while roughleaf dogwood (31.6%) was more frequent in the northern communities.

To determine variation in community composition among the 57 communities analyzed in the Trinity River Basin, a community ordination was made. Ordination procedures followed those proposed by Cox (1972) and the results obtained are presented in Figure 25. Eight clusters were inductively delineated. Community ordination generally correlated with the geographic position of communities within the basin in that the A grouping contained mostly upper-basin communities, the B grouping mostly mid-basin communities and groups E and G mostly lower-basin communities. This same correlation could apply to moisture in that the upper-basin is generally drier than the lower basin.

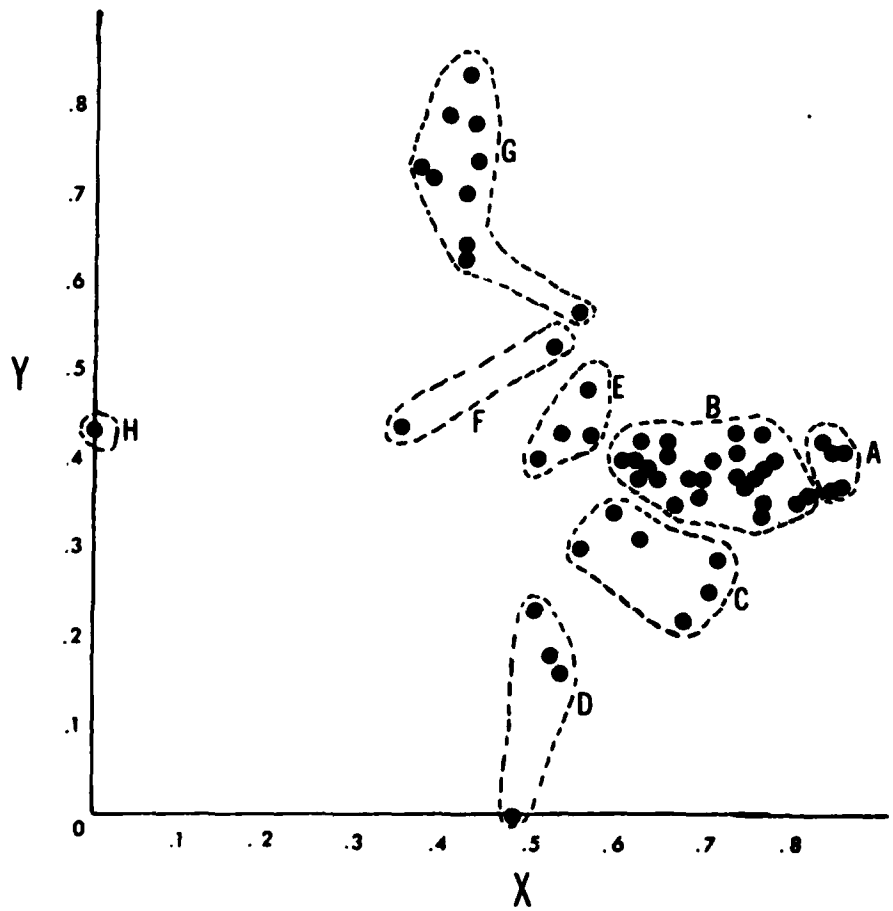

Fig. 25. Ordination of communities and delineated clusters (A - Communities 3, 4, 5, 12 and 13; B - Communities 2, 6, 7, 9, 10, 11, 14, 15, 17, 18, 19, 20, 21, 23, 24, 25, 26, 28, 29, 31, 32, 35, 38, 41 and 55; C - Communities 8, 16, 27, 40, 42 and 43; D - Communities 30, 34, 44 and 46; E - Communities 45, 49, 51 and 53; F - Communities 1 and 22; G - Communities 36, 37, 39, 47, 48, 50, 52, 54, 56 and 57; H - Community 33).

Community 33 (H cluster) was comprised almost solely of black willow with only 4 other species rarely present. As observed, this community displayed little correlation in species composition with other communities. The A cluster upper-basin communities were characterized by a preponderance of cedar elm. This species overwhelmingly dominated all 5 communities. Trees of soapberry, Texas sugarberry, green ash, hawthorn, American elm, gum bumelia and swamp privet were subordinate associates. Communities within the B cluster were generally dominated by Texas sugarberry with cedar elm and green ash as less prevalent codominants. Texas sugarberry was the top dominant in 11 of the 25 communities whereas cedar elm and green ash were dominant in 8 and 4 respectively. These 3 species, therefore, were the dominants in 23 of 25 communities in this cluster and, in addition, were the top 3 dominants in 7 communities. Other locally associated species were pecan, hawthorn, box elder (Acer Negundo), deciduous holly, roughleaf dogwood, swamp privet, bottomland post oak (Quercus similis), overcup oak, willow oak (Quercus Phellos), honey locust, water hickory and dogwood (Cornus racemosa).

Cluster C appeared to represent communities distributed on slightly drier, better drained ridge areas within the floodplain. Predominate species were green ash, post oak (Quercus stellata), deciduous holly, hawthorn, cedar elm and Texas sugarberry associated with roughleaf dogwood, white ash (Fraxinus americana), southern red oak (Quercus falcata), pecan, sweetgum and water oak (Quercus nigra). Drier terrace slopes (D cluster) contained such dominants as post oak, water oak, blue beech (Carpinus caroliniana) and yaupon (Ilex vomitoria). Principal associated species were sweetgum, black hickory (Carya texana), southern red oak and Texas sugarberry. The shrub, American beautyberry (Callicarpa americana), was also prevalent.

Communities in the lower portion of the basin (E cluster) were mostly dominated by green ash along with overcup oak and sycamore (Platanus occidentalis). Affiliated species were Texas sugarberry, hawthorn, American elm and water hickory. The shrub, American elder (Sambucus canadensis) was locally frequent.

Clusters F and G contained the more hydric communities which were much more frequent in the southern half of the basin. Cluster F contained 2 slough communities (1 and 22) composed primarily of swamp privet in association with eastern cottonwood (Populus deltoides),

box elder, water locust (Gleditsia aquatica) and green ash. The G cluster was comprised mostly of swamp communities. Communities 48, 50 and 57 were terrestrial but contained many species in common with the actual swamps. Green ash and bald cypress were the first and second dominant species, respectively, in each of these communities. Sycamore and water elm were also abundant. The swamps were dominated by tupelo (Communities 36 and 37), water elm (Communities 39 and 54), bald cypress (Communities 52 and 56) and green ash (Community 47). These same species were codominants in other swamp communities along with common buttonbush (Cephalanthus occidentalis), water locust, sycamore, overcup oak and Carolina ash (Fraxinus caroliniana).

Most of the woody species recorded in the Trinity River Basin communities are far-ranging in their distribution. They are a part of the composition of the Swamp Chestnut Oak - Cherrybark Oak (Type 91), Sweetgum - Nuttall Oak - Willow Oak (Type 92), Sugarberry - American Elm - Green Ash (Type 93), Sycamore - Pecan - American Elm (Type 94), Black Willow (Type 95), Overcup Oak - Water Hickory (Type 96), Baldcypress (Type 101), Baldcypress - Water Tupelo (Type 102) and Water Tupelo (Type 103) forest cover types of the Southern Forest region (Society of American Foresters, 1954). These types are found throughout the Southern Forest, occupying floodplains of the major rivers. Woody Trinity River floodplain species are generally abundant northward as well as eastward as indicated by more localized studies. Many of these species have been recorded in studies, including those by Nixon et al. (1973) and Nixon, Willett and Cox (unpublished data) in the Neches River floodplain of Texas, Chambless and Nixon (1974) in the Angelina River floodplain of Texas, Hefley (1937) and Ware and Penfound (1949) in the South Canadian River floodplain in Oklahoma, Bellah and Hulbert (1974) in the Republican River floodplain in Kansas and Hosner and Minckler (1963) in river floodplains in southern Illinois.

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Appendix 1. Partial checklist of herbaceous species within the Trinity River Basin including annotation of rare and endangered species generally following the Texas Organization for Endangered Species (1974) (indicated by *).

Common name	Scientific name
Agrimony	Agrimonia parviflora Ait.
Agrimony	Agrimonia rostellata Wallr.
Alfalfa	Medicago sativa L.
Alkali mallow	Sida hederacea (Hook.) Gray
Amaranth	Amaranthus arenicola I. M. Johnst.
Amaranth	Amaranthus Palmeri Wats.
Amberique bean	Strophostyles helvola (L.) Ell.
American basket-flower	Centaurea americana Nutt.
American germander	Teucrium canadense L.
American nightshade	Solanum americanum Mill.
American potato bean	Apios americana Medic.
American water-willow	Justicia americana (L.) Vahl.
Anemone	Anemone caroliniana Walt.
Anemone	Anemone heterophylla Nutt.
Annual fleabane	Erigeron annuus (L.) Pers.
Annual hairgrass	Aira elegans Gaud.
Annual yellow sweet-clover	Melilotus indicus (L.) All.
Antelope horn	Asclepias viridis Wall.

Appendix 1. Continued.

Common name	Scientific name
Arrowhead	Sagittaria graminea Michx.
Arrowhead	Sagittaria montevidensis Cham. & Schlecht
Arrowhead	Sagittaria platyphylla Engelm.
Arrowvine	Polygonum sagittatum L.
Asparagus	Asparagus officinalis L.
Aster	Aster Eulae Shinners
Aster	Aster lateriflorus (L.) Britt.
Aster	Aster patens Ait.
Aster	Aster pratensis Raf.
Aster	Aster subulatus Michx.
Atlantic pigeon wings	Clitoria mariana L.
Autumn bentgrass	Agrostis perennans (Walt.) Tuckerm.
Autumn zephyr-lily	Zephyranthes candida Herb.
Baby blue-eyes	Nemophila microcalyx (Nutt.) Fisch. & Mey.
Baby blue-eyes	Nemophila phacelioides Nutt.
Bahia grass	Paspalum notatum Flugge
Baldwin ironweed	Vernonia Baldwinii Torr.
Balloon-vine	Cardiospermum Halicacabum L.
Barley	Hordeum vulgare L.
Barnaby star-thistle	Centaura solstitialis L.
Barnyard grass	Echinochloa crusgalli (H.B.K.) Hitchc.

Appendix 1. Continued.

Common name	Scientific name
Barnyard grass	Echinochloa crusgallii (L.) Beauv. var. zelayensis (H.B.K.) Hitchc.
Basil beebalm	Monarda clinopodiodes Gray.
Basket flower	Centaurea americana Nutt.
Beak rush	Rhynchospora caduca Ell.
Beak rush	Rhynchospora capitellata (Michx.) Vahl
Beak rush	Rhynchospora globularis (Chapm.) Small
Beak rush	Rhynchospora glomerata (L.) Vahl
Beaked cornsalad	Valerianella radiata (L.) Dufr.
Beard grass	Bothriochloa saccharoides var. longipaniculata (Gould) Gould
Beard-tongue	Penstemon laxiflorus Penn.
Beard-tongue	Penstemon tenuis Small
Bear's foot	Polymnia Uvedalia (L.) L.
Beggar-ticks	Bidens discoidea (T. & G.) Britt.
Beggar-ticks	Bidens laevis (L.) B.S.P.
Beggar's-ticks	Desmodium laevigatum (Nutt.) DC.
Beggar's-ticks	Desmodium Nuttallii (Schindl.) Schul.
Beggar's-ticks	Desmodium obtusum (Willd.) DC.

Appendix 1. Continued.

Common name	Scientific name
Beggar's-ticks	Desmodium sessiliflorum (Torr.) T. & G.
Beggar's-ticks	Desmodium viridiflorum (L.) DC.
Big bluestem	Andropogon Gerardi Vitman
Bitterweed	Helenium amarum (Raf.) Rock
Bitterweed	Hymenoxys linearifolia Hook.
Black medic	Medicago Lupulina L.
Blackroot	Pterocaulon virgatum (L.) DC.
Blackseed needlegrass	Stipa avenacea L.
Black snakeroot	Sanicula canadensis L.
Bladder-pod	Lesquerella recurvata (Gray) Wats.
Bladder pod	Sesbania vesicaria (Jacq.) Ell.
Bladder sedge	Carex intumescens Rudge
Bladderwort	Utricularia subulata L.
Blazing-star	Liatris pycnostachya Michx.
Blister buttercup	Ranunculus sceleratus L.
Bloodleaf	Iresine rhizomatosa Standl.
Blue-eyed grass	Sisyrinchium Langloisii Greene
Blue-eyed grass	Sisyrinchium pruinosum Bickn.
Bluegrass	Poa annua L.
Bluegrass	Poa autumnalis Ell.

Appendix 1. Continued.

Common name	Scientific name
Blue jasmine	Clematis crispa L.
Blue larkspur	Delphinium carolinianum Walt.
Blue sage	Salvia azurea Lam.
Blue star	Amsonia illustris Woods.
Bluet	Hedyotis crassifolia Raf.
Bluet	Hedyotis nigricans (Lam.) Fosb.
Bluet	Hedyotis uniflora (L.) Lam.
Blunt-lobed woodsia	Woodsia obtusa (Spreng.) Torr.
Blunt leaf bedstraw	Galium obtusum Bigel.
Blunt spikerush	Eleocharis obtusa (Willd.) Schult.
Bog-hemp	Boehmeria cylindrica (L.) Sw. var. cylindrica
Bog marsh-cress	Rorippa islandica (Oeder) Borbas
Bog-rush	Juncus trigonocarpus Steud.
Boltonia	Boltonia diffusa Ell.
Bowlesia	Bowlesia incana R. & P.
* Branched sedge	Carex decomposita Muhl.
Brazilian vervain	Verbena brasiliensis Vell.
Britton sedge	Carex Brittoniana Bailey
Broadleaf signalgrass	Brachiaria platyphylla (Griseb.) Nash
Brome	Bromus commutatus Schrad.

Appendix 1. Continued

Common name	Scientific name
Brookweed	Samolus parviflorus Raf.
Broomsedge	Andropogon virginicus L.
Broomweed	Xanthocephalum dracunculoides (DC.) Shinners
Broomweed	Xanthocephalum texanum (DC.) Shinners
Brownseed paspalum	Paspalum plicatulum Michx.
Browntop panic grass	Panicum fasciculatum Sw.
Buckthorn	Plantago aristata Michx.
Buffalo bur	Solanum rostratum Dun.
Buffalo gourd	Cucurbita foetidissima H.B.K.
Buffalo grass	Buchloe dactyloides (Nutt.) Engelm.
Bull-nettle	Cnidoscolus texanus (Muell. Arg.) Small
Bull-thistle	Cirsium horridulum Michx.
Bulrush	Scirpus koilolepis (Steud.) Gl.
Bur-clover	Medicago polymorpha var. vulgaris (Benth.) Shinners
Burhead	Echinodorus cordifolius (L.) Griseb.
Burhead	Echinodorus rostratus (Nutt.) Englem.
Burmuda grass	Cynodon Dactylon (L.) Pers.
Butter-and-eggs	Linaria vulgaris Mill.

Appendix 1. Continued

Common name	Scientific name
Buttercup	Ranunculus abortivus L.
Buttercup	Ranunculus carolinianus DC.
Buttercup	Ranunculus pusillus Poir.
Butterfly pea	Centrosema virginianum (L.) Benth.
Butterfly weed	Asclepias tuberosa L.
* Butterweed	Senecio glabellus Poir.
Button clover	Medicago orbicularis (L.) Bartal.
Button weed	Diodia virginiana L.
Camphor-weed	Pluchea camphorata (L.) DC.
Canada wild-rye	Elymus canadensis L.
Canary grass	Phalaris canariensis L.
Canary grass	Phalaris caroliniana Walt.
Cardinal flower	Lobelia cardinalis L. var. cardinalis
Carolina clover	Trifolium carolinianum Michx.
Carolina geranium	Geranium carolinianum L.
Carolina horse-nettle	Solanum carolinense L.
Carolina modiola	Modiola caroliniana (L.) G.Don.
Carolina sedge	Carex caroliniana Schwein.
Carpet grass	Axonopus affinis Chase
Catchfly grass	Leersia lenticularis Michx.
Catchweed bedstraw	Galium Aparine L.

Appendix 1. Continued.

Common name	Scientific name
Cat-tail	Typha domingensis Pers.
Chaetopappa	Chaetopappa asteroides (Nutt.) DC.
Chain fern	Lorinseria areolata (L.) Presl.
Chasmanthium	Chasmanthium laxum (L.) Yates
Chasmanthium	Chasmanthium sessiliflorum (Poir.) Yates
Chervil	Chaerophyllum Tainturieri Hook. var Tainturieri
Chicken spike	Sphenoclea zeylanica Gaert.
Chickweed	Cerastium brachypodum (Engelm.) Robins.
Chickweed	Cerastium glomeratum Thuill.
Christmas fern	Polystichum acrostichoides (Michx.) Schott
Cinnamon fern	Osmunda cinnamomea L.
Clammy groundcherry	Physalis heterophylla Nees
Clammy-weed	Polanisia erosa (Nutt.) Iltis subsp. erosa
Clasping Venus' looking glass	Triodanis perfoliata (L.) Nieuw.
Climbing dogbane	Trachelospermum difforme Gray
Climbing fern	Lygodium Japonicum (Thunb.) Sw.
Climbing hemp-weed	Mikania scandens (L.) Willd.

Appendix 1. Continued.

Common name	Scientific name
Coast sandbur	Cenchrus incertus M. A. Curtis
Cocklebur	Xanthium strumarium L.
Common cat-tail	Typha latifolia L.
Common chickweed	Stellaria media (L.) Cyr.
Common dandelion	Taraxacum officinale Wiggers
Common green-briar	Smilax rotundifolia L.
Common horehound	Marrubium vulgare L.
Common mouse ear	Cerastium vulgatum L.
Common mullein	Verbascum Thapsus L.
Common plantain	Plantago Major L.
Common self-heal	Prunella vulgaris L.
Common sunflower	Helianthus annuus L.
Common yarrow	Achillea millefolium L.
Cone-flower	Rudbeckia hirta L.
Cone-spur bladderwort	Utricularia gibba L.
Coral bean	Erythrina herbacea L.
Coreopsis	Coreopsis cardaminaefolia (DC.) Nutt.
Cotton thistle	Onopordum Acanthium L.
Cowpen daisy	Verbesina enceloides (Cav.) Gray

Appendix 1. Continued.

Common name	Scientific name
Creeping bush clover	Lespedeza repens (L.) Bart.
Creeping rush	Juncus repens Michx.
Creeping spot flower	Spilanthes americana var. repens (Walt.) A.H. Moore
Creeping water primrose	Ludwigia peploides (H.B.K.) Raven subsp. peploides
Croton	Croton glandulosus L.
Croton	Croton Lindheimerianus Muell.
Crowfoot sedge	Carex crus-corvi Kunze
Crow poison	Nothoscordum bivalve (L.) Britt.
Cudweed	Gnaphalium falcatum Lam.
Cudweed	Gnaphalium pensilvanicum Willd.
Cupgrass	Eriochloa sericea (Scheele) Monro.
Curly-cup gumweed	Grindelia squarrosa (Pursh.) Dun. var. squarrosa
Cut-leaved evening primrose	Oenothera laciniata Hill.
Cylindric-fruited ludwigia	Ludwigia glandulosa Walt.
Daisy fleabane	Erigeron annus (L.) Pers.
Dakota vervain	Verbena bipinnatifida Nutt.
Dayflower	Commelina communis L.
Dayflower	Commelina erecta L.

Appendix 1. Continued.

Common name	Scientific name
Dayflower	Commelina erecta var. Deamiana Fern.
Deer pea vetch	Vicia ludoviciana Nutt.
Deer vetch	Lotus Purshianus (Benth.) Clem. & Clem.
Desert Christmas cactus	Opuntia leptocaulis DC.
Dichanthium	Dichanthium annulatum Stapf
Dicliptera	Dicleptera brachiata (Pursh) Spreng.
Ditch stonecrop	Penthorum sedoides L.
Dock	Rumex chrysocarpus Moris
Dodder	Cuscuta compacta Juss.
Dognettle	Urtica urens L.
Downy chess	Bromus tectorum L.
Downy ground cherry	Physalis pubescens var. integrifolia (Dun.) Waterfall
Downy milkpea	Galactia volubilis (L.) Britt.
Dracopis	Dracopis amplexicaulis (Vahl) Cass.
Drummond phlox	Phlox Drummondii Hook.
Drummond wax-mallow	Malvaviscus arboreus var. Drummondii (T. & G.) Schery
Duck potato	Sagittaria latifolia Willd.
Dwarf dandelion	Krigia gracilis (DC.) Shinners

Appendix 1. Continued.

Common name	Scientific name
Dwarf dandelion	Krigia virginica (L.) Willd.
Dwarf spikerush	Eleocharis parvula (R. & S.) Link
Dye bedstraw	Galium tinctorium L.
Ebony spleenwort	Asplenium platyneuron (L.) D. C. Eat.
Echinochloa	Echinochloa Walteri (Pursh) Heller
Eclipta	Eclipta alba (L.) Hassk.
Elephant's-foot	Elephantopus carolinianus Raeusch.
Elephant's-foot	Elephantopus tomentosus L.
Engelmann daisy	Engelmannia pinnatifida Nutt.
Eryngo	Eryngium Hookeri Walp.
Eryngo	Eryngium integrifolium Walt.
Evening primrose	Oenothera heterophylla Spach.
Eyebane	Euphorbia nutans Lag.
Fall panic	Panicum dichotomiflorum Michx.
Fall witchgrass	Leptoloma cognatum (Schult.) Chase
False dandelion	Pyrrhopappus carolinianus (Walt.) DC.
False dandelion	Pyrrhopappus multicaulis DC.
False-gromwell	Onosmodium occidentale Mack.
False pimpernel	Lindernia anagallidea (Michx.) Penn.

Appendix 1. Continued

Common name	Scientific name
False ragweed	Parthenium Hysterophorus L.
Fewflower tickclover	Desmodium pauciflorum (Nutt.) DC.
Fiddle dock	Rumex pulcher L.
Field pansy	Viola rafinesquii Greene
Fimbristylis	Fimbristylis autumnalis (L.) R. & S.
Finger dogshade	Cynosciadium digitatum DC.
Finger lionsheart	Physostegia Digitalis Small
Fireweed	Erechtites hieracifolia var. intermedia Fern.
Flat sedge	Cyperus acuminatus T. & G.
Flat sedge	Cyperus brevifolius (Rottb.) Hassk.
Flat sedge	Cyperus erythrorhizos Muhl.
Flat sedge	Cyperus globulosus Aubl.
Flat sedge	Cyperus Haspan L.
Flat sedge	Cyperus odoratus L.
Flat sedge	Cyperus ovularis (Michx.) Torr.
Flat sedge	Cyperus pseudovegatus Steud.
Flat sedge	Cyperus polystachyos var. texensis (Torr.) Fern.
Flat sedge	Cyperus retrofractus (L.) T. & G.
Flat sedge	Cyperus setigerus T. & H.

Appendix 1. Continued.

Common name	Scientific name
Flat sedge	Cyperus strigosus L.
Flat sedge	Cyperus surinamensis Rottb.
Flax	Linum rigidum Pursh var. Berlandieri (Hook.) T. & G.
Fleabane	Erigeron tenuis T. & G.
Flower-of-an-hour	Hibiscus trionum L.
Forget-me-not	Myosotis verna Nutt.
Forked blue curls	Trichostema dichotomum L.
Forked rush	Juncus dichotomus Ell.
Fourspike heliotrope	Heliotropium procumbens Mill.
Fox sedge	Carex vulpinoidea Michx.
Foxtail	Alopecurus carolinianus Walt.
Fragile fern	Cystopteris fragilis (L.) Bernh.
Fragrant cudweed	Gnaphalium obtusifolium L.
Frog-fruit	Phyla nodiflora (L.) Greene
Frostweed	Verbesina virginica L.
Franks sedge	Carex Frankii Kunth.
Fringed signalgrass	Brachiaria ciliatissima (Buckl.) Chase
Gaura	Gaura filiformis Small
Gay feather	Liatris elegans (Walt.) Michx.
Giant ragweed	Ambrosia trifida L.

Appendix 1. Continued.

Common name	Scientific name
Giant reed	Arundo Donax L.
Globe-berry	Ibervillea Lindheimeri (Gray) Greene
Golden aster	Heterotheca latifolia Buckl.
Golden aster	Heterotheca pilosa (Nutt.) Shinners
Golden groundsel	Senecio obovatus Muhl.
Goldenrod	Solidago altissima L.
Goldenrod	Solidago nitida T. & G.
Goldenrod	Solidago nemoralis Ait.
Glassleaf rush	Juncus marginatus Rostk.
Gray vervain	Verbena canescens H.B.K.
Green amaranth	Amaranthus viridis L.
Green dragon	Arisaema Dracontium (L.) Schott.
Green-eyes	Berlandiera pumila (Michx.) Nutt.
Green gerardia	Agalinis viridis (Small) Penn.
Green parrot's feathers	Myriophyllum pinnatum (Walt.) B.S.P.
Green-thread	Thelesperma flavodiscum (Shinners) B. L. Turner
Gromwell	Lithospermum incisum Lehm.
Gromwell	Lithospermum tuberosum A. DC.

Appendix 1. Continued.

Common name	Scientific name
Ground cherry	Physalis angulata L.
Ground cherry	Physalis angulata var. pendula (Rydb.) Waterfall
Ground cherry	Physalis virginiana Mill.
Groundsel	Senecio imparipinnatus Klatt
Gulf croton	Croton punctatus Jacq.
Gulf vervain	Verbena xutha Lehm.
Gummy lovegrass	Eragrostis curtipedicellata Buckl.
Gumweed	Grindelia microcephala DC.
Hairy bedstraw	Galium pilosum Ait.
Hairy four-o-clock	Mirabilis hirsuta (Pursh) MacM.
Hairyseed paspalum	Paspalum pubiflorum Fourn.
Hairy bush clover	Lespedeza hirsuta (L.) Hornem.
Hairy grama	Bouteloua hirsuta Lag.
Hairy vetch	Vicia villosa Ruth.
Hammerwort	Parietaria pensylvanica Muhl.
Hawk's-beard	Crepis capillaris (L.) Wallr.
Heartleaf nettle	Urtica chamaedryoides Pursh
Heartleaf nettle	Urtica chamaedryoides var. Runyonii Correll
Heart sorrel	Rumex hastatulus Ell.
Hedge-parsley	Torilus arvensis (Huds.) Link.

Appendix 1. Continued.

Common name	Scientific name
Hoary tickclover	Desmodium canescens (L.) DC.
Hooked pepperwort	Marsilea uncinata A. Br.
Hooker eryngo	Eryngium Hookeri Walp.
Horned rush	Rhynchospora corniculata (Lan.) Gray
Horsemint	Monarda citriodora Cerv.
Horsetail	Equisetum hyemale var. affine (Engelm.) A.A. Eat.
Horse-weed	Conyza canadensis (L.) Cronq.
Hummock sedge	Carex Joori Bailey
Hydrolea	Hydrolea ovata Choisy
Illinois bundleflower	Desmanthus illinoiensis (Michx.) MacM.
India heliotrope	Heliotropium indicum L.
Indian blanket	Gaillardia aestivalis (Walt.) Rock
Indian blanket	Gaillardia pulchella Foug.
Indian chickweed	Mollugo verticillata L.
Indian grass	Sorghastrum avenaceum (Michx.) Nash
Indian hemp	Apocynum cannabinum L.
Indian strawberry	Duchesnea indica (Andrz.) Focke
Inland sea oats	Chasmanthium latifolium (Michx.) Yates

Appendix 1. Continued.

Common name	Scientific name
Inland rush	Juncus interior Wieg.
Intermediate lions heart	Physostegia intermedia (Nutt.) Engelm. & Gray
Ironweed	Vernonia missurica Raf.
Ironweed	Vernonia texana (Gray) Small
Ivy treebine	Cissus incisa (Nutt.) Des Moul.
Japanese bushclover	Lespedeza striata (Thunb.) H. & A.
Japanese chess	Bromus japonicus L.
Jimson-weed	Datura Stramonium L.
Johnson grass	Sorghum halepense (L.) Pers.
Joint-tail	Manisuris rugosa (Nutt.) O. Ktze.
Jumpseed	Polygonum virginianum L.
Jungle-rice	Echinochloa colonum (L.) Link
Juniper leaf	Polypremum procumbens L.
Kallstroemia	Kallstroemia parviflora Mort.
Knotted hedge-parsley	Torilis nodosa (L.) Gaert.
Knotweed	Polygonum cristatum Engelm.
Lance-leaved water-willow	Justicia lanceolata (Chapm.) Small
Late-flowering thoroughwort	Eupatorium serotinum Michx.
Leaf-flower	Phyllanthus polygonoides Spreng.

Appendix 1. Continued.

Common name	Scientific name
Leaf-flower	Phyllanthus pudens Wheeler
Leather-flower	Clematis Pitcheri T. & G.
Leathery rush	Juncus coriaceus Mack.
Leavenworth vetch	Vicia Leavenworthii T. & G.
Leersia	Leersia hexandra Sw.
Lettuce	Lactuca floridana (L.) Gaertn.
Lettuce	Lactuca ludoviciana (Nutt.) Ridd.
Leucospora	Leucospora multifida (Michx.) Nutt.
Limnosciadium	Limnosciadium pinnatum (DC.) Math. & Const.
Little barley	Hordeum pusillum Nutt.
Little bluestem	Schizachyrium scoparium (Michx.) Nash
Little burclover	Medicago minima (L.) L.
Little mallow	Malva parviflora L.
Little quaking grass	Briza minor L.
Lizard's tail	Saururus cernuus L.
Loosestrife	Lythrum lanceolatum Ell.
Lopseed	Phryma leptostachya L.
Lovegrass	Eragrostis hirsuta (Michx.) Nees.

Appendix 1. Continued.

Common name	Scientific name
Lovegrass	Eragrostis hypnoides (Lam.) B.S.P.
Lovegrass	Eragrostis spectabilis (Pursh.) Steud.
Low hopclover	Trifolium campestre Sturm.
Low poppy-mallow	Callirhoe involucrata (Torr.) Gray
Lyre-leaf sage	Salvia lyrata L.
Maidencane	Panicum hemitomon Schult.
Maidenhair fern	Adiantum Capillus-Veneris L.
Marigold dogwood	Dyssodia tagetoides T. & G.
Marijuana	Cannabis sativa L.
Marsh-elder	Iva angustifolia DC.
Marsh-elder	Iva annua L.
Marsh-fleabane	Pluchea purpurascens (Sw.) DC.
Marsh purslane	Ludwigia palustris (L.) Ell.
Maryland senna	Cassia marilandica L.
Mauchia	Bradburia hirtella T. & G.
Maximilian sunflower	Helianthus Maximiliani Schrad.
Mayapple	Podophyllum pellatum L.
Mayweed	Anthemis Cotula L.
Meadow beauty	Rhexia mariana L.
Meadow beauty	Rhexia petiolata Walt.

Appendix 1. Continued.

Common name	Scientific name
Melonette	Melothria pendula L.
Mexican hat	Ratibida columnaris (Sims) D. Don.
Milk-vetch	Astragalus Nuttallianus A. DC.
Milkweed	Asclepias obovata Ell.
Milkweed	Asclepias rubra L.
Milkweed	Asclepias viridiflora Raf.
Missouri violet	Viola missouriensis Greene
Mist-flower	Eupatorium coelestinum L.
Mock bishop's-weed	Ptilimnium capillaceum (Michx.) Raf.
Mock pennyroyal	Hedeoma Drummondii Benth.
Mock pennyroyal	Hedeoma hispidum Pursh
Monkey-flower	Mimulus alatus Ait.
Morning glory	Ipomea lacunosa L.
Morning glory	Ipomea purpurea (L.) Roth
Morning glory	Ipomea trichocarpa Ell.
Muhlenburg sedge	Carex Muhlenbergii Schkuhr.
Muhly	Muhlenbergia brachyphylla Bush
Mullein	Verbascum Thapsus L.
Nama	Nama hispidum Gray

Appendix 1. Continued.

Common name	Scientific name
Narrow cell cornsalad	Valerianella stenocarpa (Engelm.) Krok
Narrow-leaved vetch	Vicia angustifolia L.
Narrow plumegrass	Erianthus strictus Baldw.
Nettle	Urtica chamaedryoides Pursh.
Nimblewill muhly	Muhlenbergia Schreberi J. F. Gmel.
Northern crabgrass	Digitaria sanguinalis (L.) Scop.
Northern frog fruit	Phyla lanceolata (Michx.) Greene
Noseburn	Tragia cordata Michx.
Noseburn	Tragia ramosa Torr.
Nutgrass	Cyperus rotundus L.
Oats	Avena fatua L.
Old field toad-flax	Linaria canadensis (L.) Dum.
Old plainsman	Hymenopappus Scabiosaeus L. Her.
Oplismenus	Oplismenus hirtellus subsp. setarius (Lam.) Mez
Ox-eye	Heliopsis helianthoides (L.) Sweet
Ozark grass	Limnodea arkansana (Nutt.) L. H. Dewey
Palafoxia	Palafoxia Reverchonii (Bush) Cory
Palafoxia	Palafoxia rosea (Bush) Cory

Appendix 1. Continued.

Common name	Scientific name
Pale dock	Rumex altissimus Wood
Pale-seeded plantain	Plantago virginica L.
Panic grass	Panicum anceps Michx.
Panic grass	Panicum brachyanthum Steud.
Panic grass	Panicum dichotomum L.
Panic grass	Panicum dilatatum Poir.
Panic grass	Panicum geminatum Michx.
Panic grass	Panicum hians Ell.
Panic grass	Panicum laxiflorum Lam.
Panic grass	Panicum Lindheimeri Nash
Panic grass	Panicum malacophyllum Nash
Panic grass	Panicum oligosanthes Schult.
Panic grass	Panicum Ravenelii Scribn. & Merr.
Panic grass	Panicum rigidulum Nees
Panic grass	Panicum verrucosum Muhl.
Panicled tickclover	Desmodium paniculatum (L.) DC.
Partridge pea	Cassia fasciculata Michx.
Partridge pea	Cassia fasciculata var. rostrata (Woot. & Standl.) B. L. Turner
Paspalum	Paspalum acuminatum Raddi

Appendix 1. Continued.

Common name	Scientific name
Paspalum	Paspalum floridanum Michx.
Paspalum	Paspalum fluitans (Ell.) Kunth
Paspalum	Paspalum laeve Michx.
Paspalum	Paspalum Lange (Fourn.) Nash
Paspalum	Paspalum praecox Walt.
Peanut clover	Trifolium amphianthum T. & G.
Pencil-flower	Stylosanthes biflora (L.) B. S. P.
Peppergrass	Lepidium virginicum L.
Perennial sweetpea	Lathyrus latifolius L.
Persian clover	Trifolium resupinatum L.
Persicaria	Persicaria densiflora (Meisn.) Moldenke
Persicaria	Persicaria setacea (Baldw.) Small
Phacelia	Phacelia hirsuta Nutt.
Phlox	Phlox pilosa L.
Pickerel-weed	Pontederia cordata L.
Pin-weed	Lechea mucronata Raf.
Pin-weed	Lechea san-sabeana (Buckl.) Hodg.
Pin-weed	Lechea tenuifolia Michx.
Pink smartweed	Persicaria bicornis (Raf.) Nieuw.

Appendix 1. Continued.

Common name	Scientific name
Pipewort	Eriocaulon decangulare L.
Pitseed goosefoot	Chenopodium Berlandieri Moq.
Plains wild indigo	Baptisia leucophaea Nutt.
Plantain	Plantago Helleri Small
Plantain	Plantago patagonica var. gnaphaloides (Nutt.) Gray
Plantain	Plantago Wrightiana Dcne.
Poke weed	Phytolacca americana L.
Polygala	Polygala cruciata L.
Polygala	Polygala ramosa Ell.
Polypremum	Polypremum procumbens L.
Pony-foot	Dichondra carolinensis Michx.
Poor Joe	Diodia teres Walt.
Potato-dandelion	Krigia Dandelion (L.) Nutt.
Poverty oatgrass	Danthonia spicata (L.) Beauv.
Powder puff	Mimosa strigillosa T. & G.
Prairie Agalinis	Agalinis heterophylla (Nutt.) Small
Prairie bush clover	Lespedeza irolacea (L.) Pers.
Prairie buttercup	Ranunculus fascicularis Muhl.
Prairie clover	Petalostemum candidum (Willd.) Michx.
Prairie clover	Petalostemum pulcherrimum (Heller) Heller

Appendix 1. Continued.

Common name	Scientific name
Prairie cupgrass	Eriochloa contracta Hitchc.
Prairie ground cherry	Physalis pumila Nutt.
Prairie-parsley	Polytaenia Nuttallii DC.
Prairie tea	Croton mononthogynus Michx.
Prairie three-awn	Aristida oligantha Michx.
Prairie wedgescale	Sphenopholis obtusata (Michx.) Scribn.
Prickly lettuce	Lactuca serriola L.
Prickly mallow	Sida spinosa L.
Prickly poppy	Argemone polyanthemos (Fedde) G. Ownbey
Primrose-willow	Ludwigia decurrens Walt.
Prionopsis	Prionopsis ciliata (Nutt.) Nutt.
Prostrate lawnflower	Calyptocarpus vialis Less.
Puncture vine	Tribulus terrestris L.
Purple amaranth	Amaranthus cruentus L.
Purple cudweed	Gnaphalium purpureum L.
Purple meadow-rue	Thalictrum Dasycarpum Fisch. & All.
Purple sandgrass	Triplasis purpurea (Walt.) Chapm.
Purple three-awn	Aristida purpurea Nutt.
Purpletop	Tridens flavus (L.) Hitchc.

Appendix 1. Continued.

Common name	Scientific name
Purslane speedwell	Veronica peregrina L.
Pygmy-flowered vetch	Vicia minutiflora Dietr.
Queen's delight	Stillingia sylvatica L.
Rabbit foot grass	Polypogon monspeliensis (L.) Desf.
Rain-lily	Cooperia Drummondii Herb.
Rattle-box	Ludwigia alternifolia L.
Rattlesnake-weed	Daucus pusillus Michx.
Red lovegrass	Eragrostis oxylepis (Torr.) Torr.
Red-seeded plantain	Plantago rhodosperma Dcne.
Red sprangle top	Leptochloa Filiformis (Lam.) Beauv.
Redtop bentgrass	Agrostis stolonifera L.
Reflexed sedge	Carex retroflexa Michx.
Rescue grass	Bromus unioloides H.B.K.
Rice cutgrass	Leersia oryzoides (L.) Sw.
Roadside gaura	Gaura suffulta subsp. suffulta Gray
Rocket larkspur	Delphinium Ajacis L.
Rockrose	Helianthemum rosmarinifolium Pursh
Rose gentian	Sabatia campestris Nutt.
Rose vervain	Verbena canadensis (L.) Britt.

Appendix 1. Continued.

Common name	Scientific name
Rosin-weed	Silphium Simpsonii Greene var. Wrightii Perry
Rough buttonweed	Diodia teres Walt.
Roundhead rush	Juncus validus Cov.
Roundleaf scurfpea	Psoralea rhombifolia T. & G.
Royal fern	Osmunda regalis var. spectabilis (Willd.) Gray
Ruellia	Ruellia caroliniensis (Walt.) Steud.
Ruellia	Ruellia humilis var. longiflora (Gray) Fern.
Ruellia	Ruellia nudiflora (Gray) Urban
Rush	Juncus nodatus Cov.
Rush	Juncus Torreyi Cov.
Rush-foil	Crotonopsis linearis Michx.
Ryegrass	Lolium perenne L.
Sacciolepis	Sacciolepis striata (L.) Nash
Salsify	Tragopogon porrifolius L.
Sand dropseed	Sporobolus cryptandrus (Torr.) Gray
Sandhills amaranth	Amaranthus arenicola I. M. Johnst.
Sand spikerush	Eleocharis montevidensis Kunth.

Appendix 1. Continued.

Common name	Scientific name
Sandwort	Arenaria patula Michx.
Scaleseed	Spermolepis inermis (DC.) Math. & Const.
Scarlet pea	Indigofera miniata Ort.
Scarlet pimpernel	Anagallis arvensis L.
Scarlet rose-mallow	Hibiscus militaris Cav.
Scarlet spiderling	Boerhaavia coccinea Mill.
Scorpion grass	Myosotis macrosperma Englem.
Scrambled eggs	Corydalis aurea Willd.
Scrambled eggs	Corydalis micrantha (Englem.) Gray
Scratch-daisy	Croptilon divaricatum (Nutt.) Raf.
Scurfy pea	Psoralea tenuiflora Pursh
* Sedge	Carex albolutescens Schwein.
Sedge	Carex amphibola Steud.
* Sedge	Carex atlantica Bailey
Sedge	Carex blanda Dew.
Sedge	Carex brittoniana Bailey
Sedge	Carex Bushii Mack.
Sedge	Carex cephalophora Muhl.
Sedge	Carex crebriflora Wieg.
Sedge	Carex cherokeensis Schwein.

Appendix 1. Continued.

Common name	Scientific name
Sedge	Carex Davisii Schwein. & Torr.
Sedge	Carex Emoryi Dew.
Sedge	Carex flaccosperma Dew.
Sedge	Carex hyalinolepis Steud.
Sedge	Carex lurida Wahl.
Sedge	Carex reniformis (Bailey) Small
Sedge	Carex retroflexa Muhl.
Seedbox	Ludwigia peploides (H.B.K.) Raven
Sensitive briar	Schrankia Roemeriana (Scheele) Blank.
Sensitive fern	Onoclea sensibilis L.
Sesbania	Sesbania macrocarpa Muhl.
Sessile-leaf tickclover	Desmodium sessilifolium (Torr.) T. & G.
Setaria	Setaria geniculata (Lam.) Beauv.
Shade betony	Stachys crenata Raf.
Shade mud-flower	Micranthemum umbrosum (Walt.) Blake
Shepherd's purse	Capsella Bursa-Pastoris (L.) Medic.
Shore milkweed	Asclepias perennis Walt.
Short ragweed	Ambrosia artemisiifolia L.

Appendix 1. Continued.

Common name	Scientific name
Shortstem iris	Iris brevicaulis Raf.
Showy primrose	Oenothera speciosa Nutt.
Sibara	Sibara virginica (L.) Roll.
Sicklepod	Cassia obtusifolia L.
Sida	Sida rhombifolia L.
Side-oats grama	Bouteloua curtipendula (Michx.) Torr.
Silver bluestem	Bothriochloa Saccharoides (Sw.) Rydb.
Silverleaf nightshade	Solanum elaeagnifolium Cav.
Singletary pea	Lathyrus hirsutus L.
Six-weeks fescue	Vulpia octoflora (Walt.) Rydb.
Skullcap	Scutellaria cardiophylla Engelm. & Gray
Sleepy-daisy	Xanthisma texanum DC. var. Drummondii (T. & G.) Gray
Slender bush clover	Lespedeza virginica (L.) Britt.
Slender rush	Juncus tenuis Willd.
Slick-seed bean	Strophostyles leiosperma (T. & G.) Piper
Slimleaf scurfpea	Psoralea tenuiflora Pursh
Slimlobe celery	Apium leptophyllum (Pers.) F. V. Muell.
Slimlobe poppy-mallow	Callirhoe involucrata var. lineariloba (T. & G.) Gray

Appendix 1. Continued.

Common name	Scientific name
Slimpod rush	Juncus difussimus Buckl.
Small-flowered vervain	Verbena bipinnatifida Nutt.
Small Venus' looking glass	Triodanis biflora (R. & P.) Greene
Smartweed	Persicaria coccinea (Muhl.) Green
Smartweed	Persicaria hydropiperoides (Michx.) Small
Smartweed	Persicaria lapathifolia (L.) Small
Smartweed	Persicaria punctata (Ell.) Small
Smooth buttonweed	Spermacoce glabra Michx.
Smooth hydrolea	Hydrolea uniflora Raf.
Smutgrass	Sporobolus indicus (L.) R. Br.
Snake-cotton	Froelichia Braunii Standl.
Snake-cotton	Froelichia Drummondii Moq.
Snake-cotton	Froelichia floridana (Nutt.) Moq.
Sneezeweed	Helenium autumnale L.
Sneezeweed	Helenium microcephalum DC.
Sneezeweed	Helenium quadridentatum Labill.
Snow-on-the-prairie	Euphorbia bicolor Engelm. & Gray

Appendix 1. Continued.

Common name	Scientific name
Snoutbean	Rhynchosia latifolia (Nutt.) T. & G.
Soft rush	Juncus effusus var. solutus Fern. & Wieg.
Softstem bulrush	Scirpus validus Vahl.
Sorghum	Sorghum bicolor (L.) Moench.
Sourclover	Melilotus indicus (L.) All.
Southern blue-flag	Iris virginica L.
Southern crabgrass	Digitaria adscendens (H. B. K.) Henr.
Southern wildrice	Zizaniopsis miliacea (Michx.) Doell. & Asch.
Southernshield fern	Thelypteris Kunthii (Desv.) Morton
Southwest bedstraw	Galium virgatum Nutt.
Sow thistle	Sonchus asper (L.) Hill
Sow thistle	Sonchus oleraceus L.
Spanish moss	Tillandsia usneoides (L.) L.
Spanish-needles	Bidens bipinnata L.
Spiderwort	Commelina virginica L.
Spiderwort	Tradescantia hirsutiflora Bush
Spiderwort	Tradescantia ohioensis Raf.
Spiderwort	Tradescantia Reverchonii Bush

Appendix 1. Continued.

Common name	Scientific name
Spikerush	Eleocharis acicularis (L.) R. & S.
Spikerush	Eleocharis austrotexana M. C. Johnst.
Spikerush	Eleocharis macrostachya Britt.
Spikerush	Eleocharis tortilis (Link.) Schult.
Spiny pigweed	Amaranthus spinosus L.
Splitbeard bluestem	Andropogon ternarius Michx.
Spotted beebalm	Monarda punctata L.
Spotted bur-clover	Medicago arabica (L.) Huds.
Spreading dayflower	Commelina diffusa Burm. F.
Spring bentgrass	Agrostis hyemalis (Walt.) B. S. P.
Spring coral-root	Corallorhiza Wisteriana Comad.
Spring ladies' tresses	Spiranthes vernalis Engelm. & Gray
Spurge	Euphorbia dentata Michx.
Spurge	Euphorbia maculata L.
Spurge	Euphorbia missurica Raf.
Spurge	Euphorbia prostrata Ait.
Spurge	Euphorbia serpens H. B. K.
Spurge	Euphorbia spathulata Lam.

Appendix 1. Continued.

Common name	Scientific name
Squarestem spikerush	Eleocharis quadrangulata (Michx.) R. & S.
Stenosiphon	Stenosiphon linifolius (Nutt.) Heynh.
Sticky hedge-hyssop	Gratiola brevifolia Raf.
Stinking-fleabane	Pluchea foetida (L.) DC.
St. John's-wort	Hypericum mutilum L.
St. John's-wort	Hypericum punctatum Lam.
St. John's-wort	Hypericum Walteri Gmel.
Sucker flax	Linum medium (Planch.) Britt. var. texanum (Planch.) Fern.
Sugarcane plumegrass	Erianthus giganteus (Walt.) Muhl.
Sunflower	Helianthus angustifolius L.
Sunflower	Helianthus hirsutus Raf.
Sunflower	Helianthus debilis Nutt.
Sunflower	Helianthus grosse-serratus Martens
Swampdock	Rumex verticillatus L.
Sweet goldenrod	Solidago odora Ait.
Tall bush clover	Lespedeza Stuevei Nutt.
Tall dropseed	Sporobolus asper (Michx.) Kunth
Tallow weed	Plantago Hookeriana Fisch. & Mey.

Appendix 1. Continued.

Common name	Scientific name
Texas aster	Aster texanus Burgess
Texas bedstraw	Galium texense Gray
Texas bluebonnet	Lupinus texensis Hook.
Texas frog-fruit	Phyla incisa Small
Texas geranium	Geranium texanum (Trel.) Heller
Texas gourd	Cucurbita texana Gray
Texas grama	Bouteloua rigidiseta (Steud.) Hitchc.
Texas groundsel	Senecio ampullaceus Hook.
Texas millet	Panicum texanum Buckl.
Texas paintbrush	Castilleja indivisa Engelm.
Texas pink-root	Spigelia texana (T. & G.) A. DC.
Texas speargrass	Stipa leucotricha Trin. & Rupr.
Texas thistle	Cirsium texanum Buckl.
Texas toad-flax	Linaria texana Scheele
Texas vervain	Verbena Halei Small
Texas yellow-star	Lindheimera texana Gray & Engelm.
Thin paspalum	Paspalum setaceum Michx.
Thoroughwort	Eupatorium incarnatum Walt.
Thoroughwort	Eupatorium perfoliatum L.

Appendix 1. Continued.

Common name	Scientific name
Thoroughwort	Eupatorium rotundifolium L.
Three-awn grass	Aristida desmantha Trin. & Rupr.
Three-awn grass	Aristida lanosa Ell.
Three-awn grass	Aristida longespica Poir.
Three-seeded Mercury	Acalypha gracilens Gray
Three-seeded Mercury	Acalypha ostryaefolia Ridd.
Three-seeded Mercury	Acalypha rhomboidea Raf.
Three-seeded Mercury	Acalypha virginica L.
Tick-seed	Coreopsis basalis (Otto. & Dietr.) Blake
Tick-seed	Coreopsis nuecensis Heller
Tick-seed	Coreopsis tinctoria Nutt.
Toad-rush	Juncus bufonius L.
Toothcup	Ammannia coccinea Rottb.
Toothcup	Rotala ramosior (L.) Koehne
Tomato	Lycopersicon esculentum Mill.
Trailing bush clover	Lespedeza procumbens Michx.
Trailing ratany	Krameria lanceolata Torr.
Trepocarpus	Trepocarpus Aethusae Nutt.
Tridens	Tridens strictus (Nutt.) Nash
Tropical crabgrass	Digitaria diversiflora Swall.
Tuckahoe	Peltandra virginica (L.) Kunth

Appendix 1. Continued.

Common name	Scientific name
Tumblegrass	Schedonnardus paniculatus Nutt.
Turnsole	Heliotropium tenellum (Nutt.) Torr.
Two-eyed berry	Mitchella repens L.
Two-flower melic	Melica mutica Walt.
Umbrella-grass	Fuirena simplex Vahl
Umbrella-grass	Fuirena squarrosa Michx.
Uruguay water primrose	Ludwigia uruguayensis (Camb.) Hara
Vahl Fimbry	Fimbristylis Vahlii (Lam.) Link
Vasey grass	Paspalum Urvillei Steud.
Velvet-leaf gaura	Gaura parviflora Hook.
Venus' looking glass	Triodanis texana McVaugh
Vetch	Vicia leavenworthii T. & G.
Vine mesquite	Panicum obtusum H.B.K.
Violet	Viola esculenta Ell.
Violet	Viola Langloisii Greene
Violet	Viola pratincola Greene
Violet wood-sorrel	Oxalis violacea L.
Virginia bugle-weed	Lycopus virginicus L.
Virginia wild rye	Elymus virginicus L.
Warty Euphorbia	Euphorbia spathulata Lam.

Appendix 1. Continued.

Common name	Scientific name
Water clover	Marsilea mucronata A. Br.
Water-feather	Myriophyllum brasiliense Camb.
Water-horehound	Lycopus rubellus Moench.
Water-hyssop	Bacopa Monnieri (L.) Wettst.
Water-milfoil	Myriophyllum verticillatum L.
Water-pennywort	Hydrocotyle umbellata L.
Water-pennywort	Hydrocotyle verticillata Thunb.
Water-primrose	Ludwigia leptocarpa (Nutt.) Hara
Wedgegrass	Sphenopholis filiformis (Chapm.) Hitchc.
* Wedgegrass	Sphenopholis intermedia (Rydb.) Rydb.
Wedgegrass	Sphenopholis longiflora (Vasey) Hitchc.
Weedy dandelion	Krigia oppositifolia Raf.
Weeping lovegrass	Eragrostis curvula (Schrad.) Nees
Western horse-nettle	Solanum dimidiatum Raf.
Western ragweed	Ambrosia psilostachya DC.
Wheat	Triticum aestivum L.
Whip-grass	Scleria triglomerata Michx.
White avens	Geum canadense Jacq.
White clover	Trifolium repens L.

Appendix 1. Continued.

	Common name	Scientific name
	White grass	Leersia virginica Willd.
	White root rush	Juncus brachycarpus Engelm.
*	White sheath sedge	Carex hyaline Boott
	White sweet clover	Melilotus albus Lam.
	White top daisy	Erigeron strigosus Willd.
	White tridens	Tridens albescens (Vasey) Woot. & Stand.
	White vervain	Verbena urticifolia L.
	Wild buckwheat	Eriogonum longifolium Nutt.
	Wild buckwheat	Eriogonum multiflorum Benth.
	Wild four o'clock	Mirabilis nyctaginea (Michx.) MacM.
	Wild indigo	Baptisia Nuttalliana Small
	Wild onion	Allium canadense L.
	Wild petunia	Ruellia Corzoi Tharp & Barkl.
	Wild petunia	Ruellia pedunculata Torr.
	Wild petunia	Ruellia strepens L. var. strepens
	Wild potato	Ipomoea pandurata (L.) Mey.
	Windmill fingergrass	Chloris verticillata Nutt.
*	Wingseed	Carex alata Torr.
	Witchgrass	Panicum capillare L.
	Winter vetch	Vicia dasycarpa Ten.
	Woods cornsalad	Valerianella Woodsiana (T. & G.) Walp.

Appendix 1. Continued.

Common name	Scientific name
Wood-sorrel	Oxalis Dillenii Jacq.
Woolly croton	Croton capitatus Michx.
Woolly rose-mallow	Hibiscus lasiocarpos Car.
Woolly white	Hymenopappus artemisiaefolius DC.
Woolly white	Hymenopappus teniufolius Pursh.
Wormseed	Chenopodium ambrosioides L.
Yellow cow-lily	Nuphar luteum subsp. macrophyllum (Small) E. O. Beal
Yellow Cress	Rorippa sessilifora (Nutt.) Hitchc.
Yellow Dock	Rumex crispus L.
Yellow-eyed grass	Xyris iridifolia Chapm.
Yellow-eyed grass	Xyris Jupicai Rich.
Yellow Nut grass	Cyperus esculentus L.
Yellow-purr	Neptunia lutea (LeavenW.) Benth.
Yellow-spine Thistle	Cirsium ochrocentrum Gray
Yellow Sweet Clover	Melilotus officinalis (L.) Lam.

Appendix 2. Partial checklist of shrub, tree, and woody vine species within the Trinity River Basin including annotation of rare and endangered species according to the Texas Organization for Endangered Species (1974) (indicated by *).

Common name	Scientific name
American basswood	Tilia americana L.
American beautyberry	Callicarpa americana L.
American elder	Sambucus canadensis L.
American elm	Ulmus americana L.
American holly	Ilex opaca Ait.
American hop-hornbeam	Ostrya virginiana (Mill.) K. Koch
American starjasmine	Trachelospermum difforme (Walt.) Gray
Amorpha	Amorpha paniculata T. & G.
Bald cypress	Taxodium distichum (L.) Rich.
Bastard indigo	Amorpha fruticosa L.
Bastard oak	Quercus sinuata Walt.
Beech	Fagus grandifolia Ehrh.
Bitter orange	Citrus trifoliata L.
Bitternut hickory	Carya cordiformis (Wang.) K. Koch
Black cherry	Prunus serotina Ehrh.
Black gum	Nyssa sylvatica Marsh.
Black hickory	Carya texana Buckl.
Black locust	Robinia pseudo-acacia L.
Black oak	Quercus velutina Lam.

Appendix 2. Continued.

Common name	Scientific name
Black walnut	Juglans nigra L.
Black willow	Salix nigra Marsh.
Blackjack oak	Quercus marilandica Muenchh.
Blue beech	Carpinus caroliniana L.
Bottomland post oak	Quercus similis Ashe
Box elder	Acer Negundo L.
Brazos hawthorne	Crataegus brazoria Sarg.
Bristly green-brier	Smilax hispida Muhl.
Buckthorn	Rhamnus lanceolata Pursh
Buffalo-gourd	Cucurbita foetidissima H. B. K.
Bur oak	Quercus macrocarpa Michx.
Burning bush	Euonymus atropurpureus Jacq.
Bush palmetto (dwarf form)	Sabal minor (Jacq.) Pers.
* Bush palmetto (trunked form)	Sabal minor (Jacq.) Pers.
Carolina ash	Fraxinus caroliniana Mill.
Carolina basswood	Tilia caroliniana Mill.
Catalpa	Catalpa speciosa Warder
Cat-brier	Smilax bona-nox L.
Cedar elm	Ulmus crassifolia Nutt.
Chaste lamb-tree	Vitex agnus-castus L.
Chestnut oak	Quercus Prinus L.

Appendix 2. Continued.

Common name	Scientific name
Chickasaw plum	Prunus angustifolia Marsh.
Chinaberry	Melia azedarach L.
Chinese tallow tree	Sapium sebiferum (L.) Roxb.
Cockspur hawthorn	Crataegus crus-galli L.
Common buttonbush	Cephalanthus occidentalis L.
Common green-brier	Smilax rotundifolia L.
Coral-berry	Symphoricarpos orbiculatus Moench.
Cow-itch	Cissus incisa (Nutt.) Des Moul.
Deciduous holly	Ilex decidua Walt.
Dewberry-blackberry	Rubus aboriginum Rydb.
Dewberry-blackberry	Rubus apogaeus Bailey
Dewberry-blackberry	Rubus saepescandens Bailey
Devil's-walking-stick	Aralia spinosa L.
Dogwood	Cornus racemosa Lam.
Downy hawthorn	Crataegus mollis Scheele
Drooping melonette	Melothria pendula L.
Drummond wax-mallow	Malvaviscus arboreus var. Drummondii (T. & G.) Schery
Eardrop vine	Brunnichia ovata (Walt.) Shinners
Eastern cottonwood	Populus deltoides Marsh.
Eastern red cedar	Juniperus virginiana L.

Appendix 2. Continued.

Common name	Scientific name
Eve's necklace	Sophora affinis T. & G.
Farkleberry	Vaccinium arboreum Marsh.
Florida basswood	Tilia floridana Small
Flowering dogwood	Cornus florida L.
Forestiera	Forestiera ligustrina (Michx.) Poir.
Fragrant sumac	Rhus aromatica Ait.
Fringe-tree	Chionanthus virginica L.
Frost grape	Vitis riparia Michx.
Giant cane	Arundinaria gigantea (Walt.) Muhl.
Green ash	Fraxinus pensylvanica Marsh.
Green hawthorn	Crataegus viridis L.
Gum bumelia	Bumelia lanuginosa (Michx.) Pers.
Hawthorn	Crataegus glabriuscula Sarg.
Heartleaf	Ampelopsis cordata Michx.
Hercules-club	Zanthoxylum Clava-Herculis L.
Honey locust	Gleditsia triacanthos L.
Honey mesquite	Prosopis glandulosa Torr.
Indian cherry	Rhamnus caroliniana Walt.
Japanese honeysuckle	Lonicera japonica Thunb.
Laurel oak	Quercus laurifolia Michx.

Appendix 2. Continued.

Common name	Scientific name
Loblolly pine	Pinus taeda L.
Maypop passionflower	Passiflora incarnata L.
Mexican plum	Prunus mexicana Wats.
Milkvine	Matelea gonocarpa (Walt.) Shinners
Mistletoe	Phoradendron tomentosum (DC.) Gray
Mockernut hickory	Carya tomentosa Nutt.
Mock-orange	Styrax americana Lam.
Muscadine grape	Vitis rotundifolia Michx.
Mustang grape	Vitis mustangensis Buckl.
Netleaf hackberry	Celtis reticulata Torr.
O'possum-wood	Halesia carolina L.
Osage orange	Maclura pomifera (Raf.) Schneid.
Overcup oak	Quercus lyrata Walt.
Parsley hawthorn	Crataegus Marshallii Eggl.
Pasture haw	Crataegus spathulata Michx.
Pawpaw	Asimina triloba (L.) Dun.
Peach	Prunus persica (L.) Batsch
Pecan	Carya illinoinensis (Wang.) K. Koch
Pepper vine	Ampelopsis arborea (L.) Koehne
Persimmon	Diospyros virginiana L.

Appendix 2. Continued.

Common name	Scientific name
Pigeon-berry	Rivina humilis L.
Poison ivy	Rhus toxicodendron L.
Possum-haw	Viburnum nudum L.
Post oak	Quercus stellata Wang.
Post oak grape	Vitis lincecumii Buckl.
Prairie rose	Rosa setigera Michx.
Privet	Ligustrum spp.
Rattan vine	Berchemia scandens (Hill) K. Koch
Rattlebush	Sesbania Drummondii (Rydb.) Cory
Red bay	Persea borbonia (L.) Spreng.
Red grape	Vitis palmata Vahl
Red maple	Acer rubrum L.
Red mulberry	Morus rubra L.
Red-berried moonseed	Cocculus carolinus (L.) DC.
Redbud	Cercis canadensis L.
Redroot	Ceanothus herbaceus Raf.
Retama	Parkinsonia aculeata L.
River birch	Betula nigra L.
Roosevelt weed	Baccharis neglecta Britt.
Roughleaf dogwood	Cornus Drummondii C. A. Mey.
Saltcedar	Tamarix gallica L.

Appendix 2. Continued

Common name	Scientific name
Sandjack oak	Quercus incana Vartr.
Sassafras	Sassafras albidum (Nutt.) Nees
Sea-myrtle	Baccharis halimifolia L.
Shagbark hickory	Carya ovata (Mill.) K. Koch
Shining sumac	Rhus copallina L.
Shortleaf pine	Pinus echinata Mill.
Shumard red oak	Quercus Shumardii Buchl.
Skunk-bush	Ptelea trifoliata L.
Slippery elm	Ulmus rubra Muhl.
Smooth alder	Alnus serrulata (Ait.) Willd.
Smooth sumac	Rhus glabra L.
Snowdrop-tree	Halesia diptera Ellis
Soap berry	Sapindus Saponaria L.
Southern arrow-wood	Viburnum dentatum L.
Southern blackhaw	Viburnum rufidulum Raf.
Southern dewberry	Rubus trivialis Michx.
Southern magnolia	Magnolia grandiflora L.
Southern red oak	Quercus falcata Michx.
* Spicebush	Lindera Benzoin (L.) Bl.
St. Andrew's Cross	Ascyrum hypericoides L.
St. Peter's-wort	Ascyrum stans Michx.
Strawberry-bush	Euonymus americanus L.

Appendix 2. Continued.

Common name	Scientific name
Sugar maple	Acer saccharum Marsh.
Summer grape	Vitis aestivalis Michx.
Swamp hickory	Carya leiodermis Sarg.
Swamp privet	Forestiera acuminata (Michx.) Poir.
Sweet grape	Vitis cinerea Engelm.
Sweetgum	Liquidambar Styraciflua L.
Sweet-leaf	Symplocos tinctoria (L.) L'Her.
Sycamore	Platanus occidentalis L.
Tassel-white	Itea virginica L.
Texas nightshade	Solanum triquetrum Cav.
Texas red oak	Quercus texana Buckl.
Texas sugarberry	Celtis laevigata Willd.
Trumpet honeysuckle	Campsis radicans (L.) Seem.
Tupelo	Nyssa aquatica L.
Virginia creeper	Parthenocissus quinquefolia (L.) Planch.
Water elm	Planera aquatica (Walt.) J. F. Gmel.
Water hickory	Carya aquatica (Michx. f.) Nutt.
Water locust	Gleditsia aquatica Marsh.
Water oak	Quercus nigra L.

Appendix 2. Continued.

Common name	Scientific name
Wax-leaf ligustrum	Ligustrum Quihoui Carr.
Wax myrtle	Myrica cerifera L.
White ash	Fraxinus americana L.
White mulberry	Morus alba L.
White oak	Quercus alba Michx.
Willow oak	Quercus Phellos L.
Winged elm	Ulmus alata Michx.
Winter grape	Vitis vulpina L.
Woolly dutchman's pipe	Aristolochia tomentosa Sims
Yaupon	Ilex vomitoria Ait.
Yellow passionflower	Passiflora lutea L.